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APPENDIX TO THE JOURNALS

OF THE

SENATE AND ASSEMBLY

OF THE

FORTY-EIGHTH SESSION

OF THE

LEGISLATURE OF THE STATE OF CALIFORNIA

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2—Report of Department of Agriculture, 1928.

3—Report of Surveyor General, 1928.

4—Report of State Board of Chiropractic Examiners, 1926–1927.

5—Report of Bureau of Purchases, 1926–1928.

6—Report of State Athletic Commission, 1926.

7—Report of State Board of Barber Examiners, 1928–1929.

8—Report of Highway Commission on Investigation of Toll Bridges.

9—Report of Joint Legislative Committee Relating to Traffic Problems.

10—Report of Joint Legislative Committee Dealing with Water Problems.

11—Report of State Narcotic Committee.

12—Report of State Bureau of Criminal Identification, 1927–1928.

13—Report of California Crime Commission.

14—Report of California Highway Commission, 1927–1928.

15—Mining in California, April, 1927.

16—Mining in California, July, 1927.

17—Mining in California, October, 1927.

18—Mining in California, January, 1928.

19—Mining in California, April, 1928.

20—Mining in California, July, 1928.

21—Report of Department of Institutions, 1927–1928.

EIGHTH REPORT

OF THE

California

Department of Agriculture

FOR THE

PERIOD ENDING DECEMBER 31, 1927

SACRAMENTO, CALIFORNIA

59098

STATE OF CALIFORNIA

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FEDERAL-STATE MARKET NEWS AND GRADING SERVICE

Dairy and Poultry Products

F. H. McCAMPBELL, Federal-State Supervisor.....*In Charge*

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THE STATE CAPITOL

The Capitol at Sacramento, showing the new extension buildings which are just being completed. The building on the left is the principal office building, and is the one in which the California Department of Agriculture is housed, while that on the right, houses the State Library, the Supreme Court, and the State Board of Education.

THE MONTHLY BULLETIN

DEPARTMENT OF AGRICULTURE

STATE OF CALIFORNIA

DEVOTED TO AGRICULTURE IN ITS BROADEST SENSE, WITH SPECIAL REFERENCE TO THE REGULATORY AND SERVICE ACTIVITIES OF THE DEPARTMENT OF AGRICULTURE.

Sent free to citizens of the State of California and offered in exchange for bulletins of the federal government, experiment stations, and other publications of a similar nature.

CHARLES KEANE ---------- Editor
O. W. NEWMAN ---------- Assistant Editor

Entered as second-class matter October 6, 1919, at the post office at Sacramento, California, under the act of June 6, 1900.

Vol. XVI. DECEMBER, 1927 No. 12

FOREWORD

AGRICULTURAL CONDITIONS in California during 1927 showed very little improvement over those of 1926. Crop conditions were favorable, but generally speaking, the net returns to the farmer were not so satisfactory. A noticeable exception to this, however, was found in the cases of cattle and sheep, where returns were uniformly good. The price of beef cattle was satisfactory and the number of cattle increased perceptibly over the previous year. The number of sheep has been steadily increasing since 1922, and the wool market was good as was also the price obtained for lambs.

The growers of field crops as a whole came through the year in fair shape, the conditions in the Middle West and elsewhere necessarily reflecting themselves in California. Returns were generally fair and even in those commodities showing a lesser total production, the financial returns were on the whole better than those of 1926. The Bureau of Field Crops has been active in its endeavors to improve the marketing of hay, grain and rice.

The outstanding problems in the fruit industry were obviously in peaches, prunes and grapes. Peach and prune marketing conditions were somewhat chaotic, but the organization of the California Vineyardists' Association aided materially in preventing what might otherwise have been a catastrophe in the grape industry and brought the majority of the growers through with something better than red ink returns.

The Federal-State Shipping Point Inspection Service, handled in connection with the Bureau of Fruit and Vegetable Standardization,

was called upon to inspect over 58,000 cars, indicating the importance which shippers are attaching to official inspection as to the quality, condition and grade of their products at time of shipment. This self-supporting service has been instrumental in eliminating delays and expenses attendant upon personal inspection and affords a definite basis for trading and for settlement of disputes and claims, etc.

Dairying has shown a uniform prosperity for the past several years. With the resignation of Dr. J. J. Frey, Chief of the Bureau of Dairy Control, that function was taken over by Dr. C. U. Duckworth, former member of the department and more recently in charge of dairy inspection for the county of Los Angeles. The dairy division has expanded its activities considerably to include an ice cream program, as well as the development of bottle exchanges, through a new containers program. New cream grading projects also have been started in cooperation with the industry and the Federal Department of Agriculture, and it is expected that during the forthcoming year this phase of the work of the Bureau will continue to expand considerably. Over 90 per cent of California, from the standpoint of population, is now included under one of the many market milk grading programs, the rapid expansion of which has placed California market milk in the forefront of the quality list in the United States.

One of the developments in the department was the taking over of the Division of Land Settlement. This work was added by the legislature of 1927, and necessitated a survey of the Durham and Delhi colonies and considerable readjustment of relations between the colonists and the state, which, it is hoped, may be concluded satisfactorily to all concerned.

Three important pest problems arose during the year, two of which were within and one without the state. The campaign against citrus white fly in the vicinity of Sacramento and nearby cities, as authorized by the legislature of 1925, was continued. The complete eradication of the pest in this area is questionable due to the fact that it is found on yard and garden plants in the more thickly populated sections. However, its presence has been reduced to a minimum where danger from the spread may largely be eliminated.

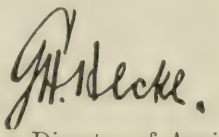
The discovery of an outbreak of the Mexican fruit fly in Texas was the occasion for sending our entomologist to the lower Rio Grande Valley to thoroughly study the problems involved in its eradication and their relation to the possible spread of the infestation to California.

One of the most unusual pest control problems of the year in which the Department aided was the effort by the fig industry to control endosepsis or internal rot of figs. The program was stimulated by the action of the United States Food, Drug and Insecticide Administration in reducing the tolerance for interstate shipment of figs to a

maximum of 10 per cent defects. It was found that under existing conditions it was difficult for Calimyrna growers to bring their dried crop within this tolerance, and a thorough investigation of fig endosepsis was made. It has been demonstrated that this disease can be controlled by sterilization of the fig tissues with which the blastophaga come in contact before they are liberated in the orchards. While this type of control program is essentially a growers' problem, the department is always ready to cooperate where it can be of service.

In the Division of Weights and Measures a change was made by the appointment of J. S. Casey as chief. This position has been vacant since 1923, and with his appointment renewed activity was manifest throughout the entire division. Among the difficult problems with which the division has to labor is the matter of weighing and measuring oils and greases and the standardizing of gasoline pumps. Nearly 10,000 gasoline pumps are operating in California at the present time. The activities of the division were augmented also by the addition of the Upholstered Furniture Act, a companion law to the Mattress Inspection Act.

An outstanding activity of the department during the past year has been the reorganization of the Division of Markets. Profitable marketing is essential to agriculture and in order to extend the utmost service in this direction the Department entered into a cooperative arrangement with the United States Bureau of Agricultural Economics in the appointment of a joint federal-state chief for the Division of Markets. Wells A. Sherman was temporarily appointed to this position, and after completing details for coordinating the work of the two departments, it was arranged that Burke H. Critchfield, marketing specialist of the United States Bureau of Agricultural Economics, should be appointed to succeed Sherman on the latter's return to Washington, D. C., early in 1928. The year closed with this division branching out into greater channels of activity which give promise of greatly benefiting the marketing of California's agricultural products.



Director of Agriculture.



THE GOVERNOR'S COUNCIL

The Legislature of 1927 provided for the reorganization of state government. At the present time nine main departments handle the administrative functions of the government. The executive heads of these departments as shown above are, reading from the center: Governor C. C. Young, and on his left, Byron R. Fitts, Lieutenant Governor; Alexander R. Heron, Finance; Earl E. Jensen, Institutions; E. B. Meek, Public Works; G. H. Hecke, Agriculture; John A. McGilvray (succeeded by Wm. J. French), Industrial Relations; Fred G. Stevenot, Natural Resources; Mrs. Anna M. Saylor, Social Welfare; Wm. J. Cooper, Education; Dr. Walter M. Dickie, Public Health.

THE MONTHLY BULLETIN

BUREAU OF FRUIT AND VEGETABLE STANDARDIZATION

W. F. Allewelt, Chief

IN 1927, as in preceding years, five distinct branches of service were maintained by the Bureau of Fruit and Vegetable Standardization:

1. Fruit and Vegetable Standardization Service.
2. Apple Standardization Service.
3. Canned Fruit Standardization Service.
4. Shipping Point Inspection Service.
5. Potato Seed Certification Service.

NEW LEGISLATION

The 1927 legislature passed three acts pertaining to the above functions. The California Fruit, Nut and Vegetable Standardization Act, Statutes 1927, chapter 865, was approved June 2 and became effective August 1, 1927. This law replaced the California Fruit and Vegetable Standardization Act of 1925, which was greatly expanded and strengthened. The additional commodities included under the provisions of the new law were juice grapes, lemons, grapefruit, persimmons, pomegranates, dates, Globe artichokes and carrots.

The new legislation was the result of demands of the fruit and vegetable industry for more complete regulations to insure the shipment of good quality products, and the elimination of as many as possible of the odd sized containers in commercial use. The difficult task of drafting the law in conformity with the wide range of conditions in various parts of the state was accomplished through the California Agricultural Legislative Committee. A general state committee on standardization was appointed, together with subcommittees for each different commodity, representing all of the commercial producing districts of the state. After a number of meetings in which the growers and shippers of each product agreed upon the provisions to govern its standardization, the law finally was drafted and recommended to the legislature with the united approval and support of the entire industry.

As a result it has been very well received and has brought about a better and more uniform standard of quality than ever before. The enforcing officials in many cases have found their program of standardization work materially increased, due to the extended scope of the new measure, but this to a great extent has been offset by the cooperation of growers and shippers in observing the provisions adopted.

The Shipping Point Inspection Service, which formerly was authorized in the California Fruit and Vegetable Standardization Act of 1925, now is being conducted under a separate enabling act, the California Fruit and Vegetable Certification Act, Statutes 1927, chapter 562, approved May 17, 1927.

The California Standard Apple Act was further amended, Statutes 1927, chapter 250, as outlined in the following report on apple standardization.

FRUIT AND VEGETABLE STANDARDIZATION

The California Fruit, Nut and Vegetable Standardization Act was one of the most important laws affecting agriculture passed by the 1927 legislature. It was sponsored, as a major project, by the California Agricultural Legislative Committee. Following careful preparatory work begun in 1926, this legislation was completed early in 1927, by committees representing the entire fruit and vegetable industry of the state, and recommended to the legislature with their unanimous support and approval.

The law was completely changed from those formerly in effect, specific provisions being adopted for each commodity named, instead of the general requirements which covered alike all of the products under the old act. This arrangement greatly clarifies the meaning of the law with respect to any fruit or vegetable, and also will facilitate any amendments found to be necessary. A number of new commodities have been included under the act, which now covers practically all of the important fruit, nut and vegetable crops of the state.

Because of the many changes incorporated in the new act representatives of the Department, with the county horticultural commissioners, held a number of meetings in various parts of the state, in order to acquaint all growers, packers and shippers with the new provisions before they became effective. This procedure very materially assisted in preventing difficulties in the enforcement work, and the officials have had the full and cordial support of the industry in carrying out their standardization program.

The inclusion of several new commodities, together with increased production and shipments, required a great deal of additional work on the part of the enforcing officials, and for this reason was responsible for an increase in the forces of many of the county horticultural commissioners, to provide for adequate inspection.

Realizing the necessity of proper standardization of farm products the growers and dealers have given the enforcing officials their full support and cooperation in making effective the provisions of the new act.

The California Standard Apple Act also was amended, following a number of meetings held by the Department with growers and shippers, and with a committee representing all of the commercial producing districts of the state, in order to determine the changes desired by the industry. Before the season opened meetings were held in each section, in order to fully advise all growers, packers and shippers of the provisions of the revised law. In the Sebastopol and Watsonville districts committees were selected by the local organizations of growers and shippers to assist in the determination of proper maturity, and because of this cooperation very little difficulty was experienced in this work.

Many cars of apples were analyzed for spray residue and certified for export shipment to foreign markets, which received practically half of the northern Gravenstein crop, and a substantial proportion of the Watsonville Newtown Pippins. The apple stamp was universally used in these two important districts, and practically every car was shipped under federal-state certification.

SHIPPING POINT INSPECTION AND CERTIFICATION OF FRUITS AND VEGETABLES

The federal-state inspection of fruits and vegetables was employed more extensively by the industry in 1927 than in any former year, a total of 58,063 carlot shipments being certified. This was more than one-fifth of the record movement of 272,513 carloads of fresh fruits and vegetables from California shipping points during the year. This official certification on the basis of United States grades—nationally recognized trading standards—is becoming recognized very generally as the most satisfactory means of description in the sale and purchase of these products.

SEED POTATO CERTIFICATION

The certification of seed potatoes increased 50 per cent over the previous year. Nearly all of the seed potatoes used in California are brought in from other states, and most of the supply is limited in producing value by the general prevalence of virus diseases, which can be eliminated only by the methods followed in growing certified seed. Many California growers now are attempting, with the assistance of the seed potato certification service of the Department, to grow disease free high yielding seed for use in this state. To assist in developing a suitable foundation stock for these growers the Department has been using the tuber unit method and field plot system for testing and growing disease free seed.

CANNED FRUIT STANDARDIZATION

During 1927, 115 canning plants packed 16,775,235 cases of apricots, cherries, peaches and pears, under the supervision of the Department and in compliance with the provisions of the California Canned Fruit Standardization Act. Stringent grading of the fruit received by the canners, and greater care in its preparation, resulted in an improved product. Very little difficulty was experienced by any of the packers in complying with the requirements of the law, and no appeals from any enforcement action were referred to the Board of Arbitration.

FRUIT AND VEGETABLE STANDARDIZATION, 1927*

The new California Fruit, Nut and Vegetable Standardization Act of 1927, approved June 2, became effective August 1. The provisions of this law were greatly improved over those of the former legislation, particularly in the detailed specifications adopted for each commodity instead of the general blanket requirements which covered all products in the old act. This arrangement also will make it possible to amend

* By H. W. Poulsen, Supervising Inspector in Charge.

the provisions governing any commodity without affecting the growers and shippers of other products who are in no way concerned with the changes which may be desired. General provisions of the new act provide for the manner of its enforcement and include the specifications for standard containers, marking requirements, etc. Mislabeling and deceptive packs or arrangement are prohibited, not only in the case of the 34 commodities specifically named in the act, but in the packing, shipment, offering for sale or sale of all fresh or dried fruits, nuts or vegetables.

Due to the enlarged scope of this new law as well as the inclusion of a number of commodities not covered by the old act, and the increased shipments of fruits and vegetables from California during 1927 over those of 1926, the county horticultural commissioners, who are charged with the enforcement of this act under the general supervision of the State Department of Agriculture, in many cases have increased their forces, especially during the harvesting seasons of the



FIG. 144. A standard pack of head lettuce showing crushed ice between layers. The law provides for standard packs as well as a minimum standard of quality.

various commodities which are of importance in their respective counties. For the same reasons the representatives of the Department have been especially active in assisting the commissioners to bring about a uniform and efficient administration of the law in the various counties.

After the new law was passed and before its provisions became effective it was discussed in detail by members of the Bureau of Fruit and Vegetable Standardization at meetings of the state and local associations of the county horticultural commissioners, as well as meetings of the horticultural inspectors held by the commissioners in many individual counties. At these meetings the provisions of the new law were thoroughly explained in detail, and considerable time was devoted to discussion, with the result that everyone in attendance was

acquainted with the requirements of the law as applied to their own particular problems and the commodities in which they were especially interested.

In addition to these, a great many public meetings were held by the county horticultural commissioners and representatives of the Department, at which every possible effort was made to acquaint the growers and shippers of the various commodities with the detailed provisions governing the standardization of the products which they were handling. This program was of material assistance in inaugurating the administration of the new law and securing the assistance and cooperation of the industry in the general observance of its provisions. The results have proved more than satisfactory.

In the commodities formerly covered by the law the greatest change affected by the 1927 act is that in the provisions applied to grapes. These now may be shipped under any one of seven grades specifically defined, and juice grapes, which previously had been covered only so far as maturity was concerned, now are definitely regulated as to quality. This fact, together with the greatly increased shipments of grapes, materially increased the enforcement work, and practically all of the commissioners in the important grape growing counties met the situation by the employment of additional inspectors, resulting in the shipment of a product of higher quality and better grade leaving the state. One problem which required considerable attention was the change in the maturity requirement for Thompson Seedless, Malaga and Muscat grapes from 17 per cent to 18 per cent soluble solids content, which became effective August 1. Some difficulty was found in the enforcement of marking requirements on all containers of juice grapes, required by the new law for the first time, but after a few weeks of thorough inspection fairly good results were obtained in most cases. The strict and uniform enforcement of the law in all sections of the state can well be given a part of the credit for the fact that in spite of heavy shipments prices obtained for grapes during most of the season were generally slightly higher than for the two years previous.

Less difficulty was experienced in the enforcement of the law on cantaloupes than in 1926, due perhaps to the fact that because of more favorable growing conditions the quality of the crop generally was considerably better, with higher sugar content. Most of the cantaloupes in the state were shipped prior to the date on which the new law became effective, after which the maturity requirement was changed from 9 per cent soluble solids in juice to 8 per cent, which now applies.

No particular difficulty was experienced in the shipment of the Valencia orange crop during the spring and summer months of the year, excepting the rejection of a number of large lots on account of Cladosporium rot. The early navel orange season gave little difficulty except in the enforcement of the new provision that no oranges may be accelerated in color unless they meet the 8–1 maturity test. In previous seasons there was nothing to prevent the sweating of oranges which were picked with 70 per cent color before meeting this test, and for that reason a number of shippers had to be warned that this prac-

tice no longer could be followed. The exemption from the maturity requirements, which applied to oranges exported to foreign countries other than Canada after the last of October, was eliminated in the new act, this change resulting in the exportation of more palatable fruit. In spite of the late season, with but few exceptions the packers and shippers of the state adhered to the maturity and color requirements of the new law, thus assisting in the maintenance of exceptionally good prices which have been received for this crop.

Globe artichokes for the first time have been included under the provisions of the new standardization act, which sets up specifications for "Fancy" and "Unclassified" artichokes. Representatives of the Department assisted the county horticultural commissioners in the producing areas in holding meetings with the growers and carrying on the inspection of this commodity, with results which have been excellent. Two of the greatest difficulties which formerly have been met



FIG. 145. Strawberries placed loose in the standard basket carry better in transit, save packing costs and serve to eliminate deception which is a violation of the law.

in the marketing of this crop have been worm injury and freezing injury, and it has been possible to practically eliminate both of these in the stock which has been marketed this year.

Many meetings with growers in connection with the standardization of strawberries have been held with fairly satisfactory results. However, it has been necessary to conduct a number of successful prosecutions on account of the persistence of some growers in putting up deceptive packs. The new law specifies that if strawberries are face packed all of the berries in any container must be sized within one-fourth of an inch variation in diameter. Because of the strict enforcement of this rigid provision, after it became effective during the latter

part of the season, a great many of the strawberry growers in the state now are using loose filled containers, which greatly reduces the tendency to put up deceptive packs.

Tomatoes received from Mexico and Arizona during the year in many cases were badly affected with nail head spot, and much difficulty was experienced with Mexican shipments during the winter months because of deception and poor quality. For these reasons thousands of boxes of tomatoes have been rejected and caused to be reconditioned before being offered for sale, including the rejection of one ship load of 11,000 boxes in San Francisco. During the fall months tomatoes grown in southern California were seriously injured by worms and late blight, with the result that much enforcement work was necessary. Shipments finally were discontinued on account of the prevalence of late blight which, even after the most rigid sorting, continued to develop in transit.

Considerable attention was given to the enforcement of the new provision of the law which requires marking of all containers of domestic or imported dates to show the name of the state or country of their origin. Although celery, asparagus, fresh peas and beans are not covered by specific requirements of the act, they are governed by section 12, which prevents a deceptive pack or mislabeling in any fresh or dried fruits, nuts or vegetables, and representatives of the Bureau, in cooperation with various county horticultural commissioners in the growing sections, have inspected many shipments of these and other commodities in order to eliminate such deceptive packs and mismarking. In some cases prosecutions have been necessary, and the results of this work have been excellent, being much appreciated by the industry.

Highway inspection of various commodities which are transported by truck has been continued as in the past seasons, and in several cases new inspection stations have been established. In addition to the inspection stations formerly maintained in Imperial Valley, Los Angeles, Kern, Fresno, Merced, Santa Cruz, Sonoma and Stanislaus counties, the horticultural commissioners of San Joaquin and Stanislaus counties cooperated in the establishment of an inspection station located on the main highway leading to the San Francisco Bay market, with the result that produce delivered over this route has shown a marked improvement in quality. This inspection also has greatly increased the demand for clearance tags issued by the inspectors at the point of origin on such shipments. During 1927 the horticultural commissioners in the larger cities of the state have devoted much additional time to the inspection of products in their markets, with appreciable results in the improvement of quality.

Too much credit can not be given for the undivided support which the industry has given the Department of Agriculture and the county horticultural commissioners in the thorough and uniform enforcement of the standardization law. The growers and shippers realize that adequate standardization is essential for the successful maintenance of their business, and have given their full cooperation to the enforcing officials engaged in carrying on this work.

APPLE STANDARDIZATION, 1927*

As in previous years, the 1927 legislature was requested to amend the California Standard Apple Act. The principal changes made were:

1. Establishment of a definite standard for "Unclassified," the lowest grade permitted for sale.

2. Establishment of grades for "Fancy Loose" and "C Grade Loose" apples; requirements identical with corresponding packed grades except that apples need not be packed and must not be smaller than $2\frac{3}{8}$ inches in diameter.

3. The early cooking varieties Red Astrachan, White Astrachan, Alexander and Beitigheimer no longer need to be *mature* to meet Fancy and C grades.

4. Internal browning which can not be detected by external examination now is permitted in the "Fancy," "C," and "Unclassified" grades.

5. The addition of the half-box as a standard container.

6. Provision in application of grades that entire lot must average within tolerance established, and that not more than one-fourth of the packages may exceed the tolerance by not more than one-half of the tolerance allowed.



FIG. 116. Examination of apples in cold storage, to determine grade [illegible]

* By C. H. Beasley, Supervising Inspector in Charge.

Notwithstanding the confusion which changes in the standardization law generally cause, the enforcement work has been carried out with comparatively little difficulty. The harvesting seasons in the leading districts were preceded by growers' meetings held by the Department, acquainting the industry with the new requirements which were made operative from the first of the season to avoid changing when the law became effective July 29, 1927. In this work the new organizations of the apple growers in both centers of production were of great assistance. At the request of the Department, these associations in Sebastopol and Watsonville appointed committees of growers to assist the enforcing officials in deciding cases where maturity was in question. This arrangement was remarkably successful, and eliminated practically all of the friction and disputes resulting from this problem during previous seasons.

Enforcement work was better organized this season than ever before. Men were situated in the most strategic points to observe the marketing of apples, namely, San Francisco Bay region, San Joaquin Valley towns and southern California. These men were in constant touch with the county horticultural commissioners, who also are authorized to enforce the apple act, in the centers of consumption as well as in the producing districts. Besides continuing the inspection of truck shipments on the highways from the principal producing districts, a large force of state inspectors was maintained in the Sebastopol and Watsonville districts, which include the larger part of the state's commercial apple production.

The season as a whole was marked with the best of cooperation between inspectors and shippers, and general satisfaction with the enforcement and certification work. The prompt and free analysis of export apples, and the issue of federal-state export certificates were greatly appreciated by the industry in meeting the spray-residue problem. Approximately half of the Gravenstein shipments, and a large proportion of the Watsonville stock were analyzed and certified for export.

The use of the state apple stamp was universal in both of the principal districts, and practically every car was shipped under a federal-state certificate. A total of 3565 cars and 4002 truck loads of apples (466,003 boxes) was inspected during the calendar year. A total of 44,167 boxes was rejected during the season.

CANNED FRUIT STANDARDIZATION, 1927*

The canning season of 1927 closed the second year of the enforcement of the Canned Fruit Standardization Act passed by the 1925 legislature, which became effective January 1, 1926, and applies to the canning of apricots, cherries, peaches and pears.

The law establishes minimum grades for the above named canned fruits, requiring the marking by embossing or lithographing of all grades below "Standard," this being the third grade of the syrup or table fruits. Grades below "Standard," with a minimum of 10 degrees

* By W. H. Tuggle, Supervising Inspector in Charge.

of added sugar to the liquid surrounding the fruit, are required to be indelibly embossed or lithographed in letters not less than one-fourth of an inch high, on the top of each can, with the word "Seconds," and where there is no sugar added, "Seconds Without Added Sugar." This covers all packs of these fruits, whether packed for remanufacture or for consumption, except dietetic fruit which is of a grade materially better than "Seconds" and packed without added sugar. In this instance the law requires that notation be carried on the label "Packed Without Added Sugar."



FIG. 147. Testing percentage of sugar in syrup being added to "Standard" and "Seconds" grades of canned fruits.

The law was administered as in the previous year. The state was divided into five districts, with one inspector in each under the direction of the supervising inspector.

In 1926 there were operated in the state 120 canneries packing fruits which came under the provisions of the Standardization Act. The canners packed a total of 20,974,700 cases of all fruits in 1926, as compared with 1927, with a total pack of all fruits from 115 canneries, amounting to 16,775,235 cases, including the following:

	1926	*1927*
Apricots	3,390,418 cases	3,116,713 cases
Cherries	526,520 cases	170,909 cases
Pears	2,044,414 cases	1,929,805 cases
Peaches (Freestone)	817,319 cases	320,812 cases
Peaches (Clingstone)	13,654,758 cases	10,829,681 cases

It will be noted that in 1927 there was a material reduction in the pack of cling peaches, due largely to more strict grading of the fresh fruit for canning purposes. Also a very large reduction in the number of cases of cherries due to the shortage in the crop. There also was a carry-over in both canned cherries and cling peaches into the new year, which had a tendency to reduce the size of the pack during this season, while pears were about the same as the previous year, showing only a slight reduction in the pack.

Due to the more stringent grading of the fresh fruit the pack of peaches was of higher quality in 1927, there being much less fruit of the lower grades packed than in previous years.



FIG. 148. Inspection of canned fruit, with superintendent of plant, to determine quality, size, and density of syrup, as required by law.

This year all of the canners being more familiar with the law, as they had passed through one season of enforcement, were able to comply with the provisions, materially decreasing the number of infractions by oversight or otherwise.

Due to close inspection, and hearty cooperation of the canners with this department, another year passed without the necessity for calling upon the Board of Appeal for any arbitration, as all matters of grade and marking were settled harmoniously between the canners and the representatives of the Bureau.

SHIPPING POINT CERTIFICATION OF FRUITS AND VEGETABLES, 1927

A considerable increase in the federal-state certification of California fruits and vegetables occurred in 1927, and more than 58,000 carload lots were inspected. This work has shown a remarkable growth since its inception in 1920, as indicated in the accompanying table.

As in former years, the greater part of the work consisted of grape inspections, and in the months of September and October when the movement of this crop was at its height, it was necessary to maintain a force of more than 200 inspectors. Certification of vegetables also is showing an increase each year, and 42 different products are represented in the total figures.

The United States grades for fruits and vegetables gradually are becoming the basis of trading, and on all products covered by such standards they generally are used in the certification of shipments.



FIG. 149. Federal-State shipping point inspector writing a certificate covering a car of cauliflower. The loading and icing are reported as well as the quality, condition and grade of the product.

CARLOT INSPECTIONS OF FRUITS AND VEGETABLES BY YEARS AND MONTHS, JULY 1, 1920, TO DECEMBER 31, 1927

Month	1920	1921	1922	1923	1924	1925	1926	1927
January	.....	299	347	798	1,218	983	1,204	1,127
February	.....	359	299	602	1,237	1,269	1,393	1,126
March	.....	243	1,126	990	839	1,522	1,330	693
April	.....	111	649	247	924	1,386	564	823
May	.....	654	1,488	941	1,843	2,287	2,095	2,202
June	.....	447	1,085	2,004	2,423	2,680	1,456	1,857
July	105	741	993	3,141	2,020	2,160	3,359	1,449
August	400	879	1,377	4,185	2,986	3,055	4,939	5,921
September	1,125	2,482	3,453	11,634	10,812	19,275	17,589	20,167
October	1,070	2,566	3,578	10,895	7,208	16,603	13,170	18,577
November	868	997	1,849	6,417	3,214	2,264	3,115	3,088
December	396	351	1,053	1,650	1,165	883	801	1,033
Totals	3,964	10,129	17,297	43,564	35,889	54,367	51,015	58,063

CARLOT SHIPMENTS AND INSPECTIONS OF FRESH FRUITS AND VEGETABLES, YEARS 1920 TO 1927, INCLUSIVE

	1920	1921	1922	1923	1924	1925	1926	1927
Shipments	147,813	169,945	168,115	214,601	212,209	231,517	259,048	272,513
Inspections	3,964	10,129	17,297	43,564	35,889	54,367	51,015	58,063
Per cent inspected	2.7	6.0	10.3	20.3	16.9	23.5	19.7	21.3



FIG. 150. Federal-State shipping point inspector examining table grapes for certification. Representative samples are selected and inspected during the loading of the car.

CARLOT INSPECTIONS BY COMMODITIES, 1927

Fruits		*Vegetables*			
Apples	3,547	Artichokes	4	Honeydews	23
Apricots	7	Asparagus	3	Lettuce	4,783
Grapes	38,297	Beans	4	Onions	1,433
Grapefruit	32	Beets	1	Parsley	17
Lemons	34	Cabbage	74	Peas	95
Oranges	303	Cantaloupes	1,195	Peppers	23
Peaches	775	Carrots	531	Potatoes	669
Pears	1,522	Casabas	1	Spinach	4
Plums	2	Cauliflower	1,545	Squash	1
Quinces	4	Celery	813	Sweet anise	1
Raisins	1	Chicory	23	Sweet potatoes	1
Strawberries	30	Cucumbers	1	Tomatoes	1,880
Walnuts	12	Endive	2	Turnips	3
Mixed fruit	37	Garlic	9	Watermelons	10
				Mixed vegetables	311
Total fruit	44,603	Total vegetables			13,460
		Grand total			58,063

SEED POTATO CERTIFICATION, 1927*

The work in seed potato certification the past season has been a continuation of the program carried on from 1926, namely, inspection of stocks for certified seed, and development of foundation stocks of certain varieties to be used in the production of certified seed.



FIG. 151. Two plants of the Garnet Chili variety. Plant on the right is healthy; one on the left infected with leaf-rolling mosaic, a virus disease. Note the dwarfing in size, of diseased plant, small leaves and slightly rolled. Taken from a field with over 95 per cent of the plants infected with this disease.

Out of a total of 102 acres entered for certification, 82 were certified, with a production of approximately 17,800 bushels of certified seed. Stocks certified have been mostly of the British Queen variety, which is produced for the early potato growers of the southern coastal districts, largely in San Diego County. Eight carloads of this variety were shipped last season, and over twelve this season, a 50 per cent increase. A further healthy growth in the production of certified seed of this variety is expected next year. This stock has been produced in the northern part of Marin, Sonoma, Mendocino and Humboldt counties.

The development of foundation stocks has been centered almost entirely on the Pride of Wisconsin or White Rose variety. This

* By J. E. Currey, Specialist in Charge.

variety is grown on about two-thirds of the potato acreage of the state. No stocks have been found sufficiently free of virus diseases to certify for seed, which is unusual in consideration of the large acreage planted. Stocks imported into the state to date, while usually somewhat better than local grown stocks, still are far from the standards which it is necessary to maintain in seed potato certification.

The above work has been carried on with growers in the Tehachapi mountains and northern counties, by the use of the tuber unit method and seed plot system combined. In some instances progress has been made, and in others very little headway was possible due to the presence of a large number of insect carriers of the virus diseases. In order to speed up this work and make progress more certain, plans have been made to use the tuber-indexing method of determining healthy tubers, in connection with the tuber-unit and seed plot work. The tuber-indexing is accomplished by cutting an eye with a sufficient amount of tuber to make a seed piece for planting from each tuber, and



FIG. 152. On right yield of healthy hill of Garnet Chili, 2 lbs. 4 oz., all marketable tubers. On left yield of leafrolling hill of Garnet Chili—10 oz., no marketable tubers.

planting this in a greenhouse or nursery during the winter to determine if such tuber will produce healthy plants. A careful record is kept of each tuber and seed piece planted. Only those producing healthy plants are saved to plant in the field the following season by the tuber unit and seed plot method.

This system will give a small amount of stock practically free from the important virus diseases for propagation purposes. It will greatly increase the possibility of growing stock containing a low percentage of such diseases, thereby eliminating the necessity of working with stocks that contain such high percentages as to make the results of improvement doubtful for the next season. Two problems, the masking of symptoms under field conditions, and the rapid increase of insect carriers of the diseases, make improvement by field roguing alone a very difficult task under California growing conditions. The tuber index method, supplementing the work of tuber-unit planting and seed-plot work, will be a great help in the development of foundation stocks.

The Bureau at present is doing this work with the cooperation of a Sacramento nursery. The future no doubt will develop the need of larger greenhouse space, built especially to take care of this type of work.

TUBER INDEXING AS A METHOD FOR DEVELOPING FOUNDATION SEED POTATO STOCKS

By J. E. Currey, Potato Specialist

THE limiting factor in the development of stocks of seed potatoes suitable for certification is largely control of the virus diseases, represented by the three groups—mosaic, leafroll and spindle-tuber. This is true for every seed potato growing section in the United States with perhaps one or two exceptions. In some areas it is possible to keep the virus diseases to a minimum percentage by field roguing, seed plot or tuber-unit planting. These methods are suitable to the northern states where cool growing summer temperatures prevail and insect carriers of the diseases are at a minimum.

Farther south, where higher summer temperatures and mild winters exist, other methods must be employed. The masking of mosaic symp-



Fig. 153. Tuber indexes planted for five thousand tubers.

toms during the growing season is caused by high growing temperatures, producing a condition impossible of diagnosis. Mild winters with high summer temperatures aid the early and rapid increase of insect carriers, such as aphis. A very large increase in these diseases consequently often is evident the following season. An infection as small as 5 per cent often will increase to 50 or 100 per cent in a single season.

Therefore it is necessary for potato growers in these more southern sections to have for propagation each year a small amount of stock practically free from these virus diseases. This stock should be grown by itself and kept sufficiently isolated from other potatoes to prevent possible outside infection. It must be developed from stocks already carrying very high percentages of the disease. In the case of the variety Pride of Wisconsin or White Rose, a variety largely planted

in California, so far there have been found no lots containing what might be called low percentages of the disease, and none suitable for seed potato certification.

TUBER INDEXED STOCK

Through tuber indexing we find a way to obtain these stocks. This method provides for removing from each individual tuber an eye with sufficient material surrounding it to produce a plant, and propagating such seed piece under controlled growing conditions. The plant thus obtained will indicate the kind of plants that may be expected from the tuber in field planting. Equipment necessary for this work consists of a greenhouse or nursery, where temperature conditions can be controlled, as the growing usually is done during the winter months and it is only under certain temperatures that correct disease symptoms are obtained.

SOIL

Soil used should contain all the elements necessary to produce a rapid and vigorous growth. The ordinary composts used in the greenhouse usually will be sufficient, or any loam soil with a heavy application of barnyard fertilizer mixed in thoroughly. It is well also to add any element that is lacking in the soil by the use of a readily available commercial fertilizer. Six inches is a good depth for the soil, although this may be deeper with good results. This depth allows space for a fair root development and also retains sufficient moisture to prevent rapid drying out.

SIZE OF TUBERS USED

Tubers used may be of any size, but that which will average two ounces to the eye for later propagation may be considered best. This



FIG. 154. Same as figure 153, three weeks later.

will usually be from a twelve ounce up tuber, depending, of course, on the variety, as some varieties produce more eyes than others. Large tubers are profitable to use, provided they have plenty of eyes.

CUTTING SEED

The seed piece is cut from any part of the tuber. When taken from the blossom or seed end sprouting will take place more quickly, depending upon the length of the rest period the tuber has passed through. With normal stock the blossom end usually will produce a more vigorous plant.

Up to date no experimental evidence has proven that one part of the tuber may be infected with a virus disease and the balance healthy. The translocation of the starch from the leaf to the tuber is a fairly rapid process, being at its maximum in the leaf at 6 p.m., and at its



FIG. 155. Showing method of cutting seed pieces for tuber indexing and also manner of labeling.

minimum at about midnight.[1] Also the blossom end of the tuber is the fastest growing portion and it is doubtful if the flow of sap would stop at the stem end and not carry on to the remainder at any time during its connection with the upper portion of the plant. The activity of the cells during transpiration and respiration processes, and the interchange of cell products also eventually would result in the infection of all parts of the tuber with any virus which happened to be located in any one portion. No proof so far has been offered to indicate the need of testing any special part of the tuber, for instance, the stem end.

Blocky seed pieces will decay less readily than thin or poorly shaped pieces. Pieces one-half ounce to one ounce in weight are sufficiently large to produce a good growth and give the plant a proper start, depending somewhat on the character of the seed. Properly grown, vigorous seed will do well with smaller pieces. Figure 3 shows a desirable method of cutting the seed pieces.

DEPTH AND DISTANCE BETWEEN PLANTINGS

Experience has shown that two to three inches is a good depth to plant the seed piece. Root formation takes place at the base of the sprout and at the nodes up to the surface of the soil. This depth of planting allows sufficient space for root formation to produce a vigorous plant.

Very good results have been obtained by the Department in plantings two inches apart in the row, with rows four inches apart. With spacings as close as this it is necessary to go through and cut out the plants that first become large enough for diagnosis, permitting those of slower growth to develop. Three inches apart in the row and three inches between rows gives a better arrangement for limited space. Greater distances in the row and between the rows help greatly in eliminating errors and should be used whenever possible.

METHOD OF PLANTING AND CARE OF RECORDS

Operations of cutting seed, planting, numbering and labeling all must be arranged and performed in a systematic manner in order to eliminate errors. Numerous errors will creep in and nullify the accuracy of the work unless a definite system is adopted and applied in every step. There should be sufficient checks to determine at intervals of every ten or twenty tubers that labels on them coincide with corresponding labels on the index.

The following system adopted by the Department in its work has proved very satisfactory. Fifteen to twenty tubers were laid out in order near the planting space. Tubers were marked by writing the proper number on the surface with an indelible pencil. The seed pieces then were removed and laid in order with the tubers. Next

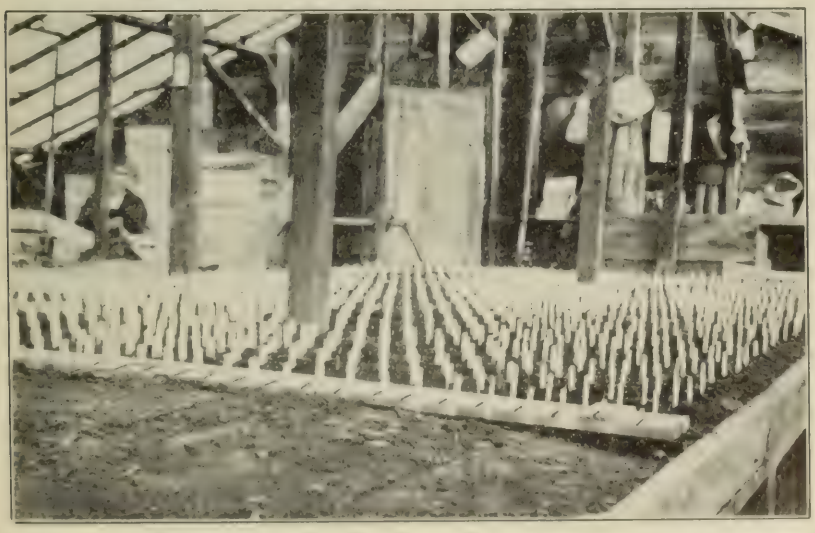


FIG. 156. Planting board spaced at regular intervals for planting seed pieces.



FIG. 157. A healthy index.

these were picked up in order and planted by using a pointed stick of proper size to make an opening in the soil. A board with the proper planting spaces marked off and proper width to give the distance between rows was used (Fig. 156). With the seed pieces planted in order at the markings on the planting board, stakes, consisting of pot labels, were placed in front of the seed pieces. The stakes had been numbered previously, and being in order were placed readily at the marks. A numbered tag then was fastened to each tuber by a strong rubber. These remain firmly attached and can be placed in sacks for storing, thus holding their identity for later sorting. Before removing from the place of planting, the labeled tubers were checked up carefully as to the corresponding numbers on stakes, and any irregularity corrected. This is very important as one mistake, unless corrected, may throw out of rotation a large number of tubers. (Figure 156 shows the planting board with marks for seed pieces to be planted at regular intervals.)



FIG. 158. An index showing mild mosaic symptoms, slight ruffling and wrinkling. Mottling not visible in photograph.

TEMPERATURES

Temperatures to be maintained in the greenhouse will vary in accord-

ance with the type of virus disease for which it is desired to obtain symptoms. Comparatively high temperatures may be maintained for spindle-tuber, but mosaic requires lower temperatures with a constant no higher than 71.6° F. At this temperature mild mosaic will show only slight and diffused mottling, with wrinkling and ruffling also disappearing. At 78.8° F. symptoms of mottling disappear entirely, as previously has been described for Green Mountain and Bliss Triumph varieties.[2] The Pride of Wisconsin, or White Rose, as known in California, and designated by Prof. William Stuart of the United States Department of Agriculture as American Giant, is similar to the Bliss Triumph in its characteristics of easily masking symptoms of mosaic under high temperatures, so we may conclude the above temperatures will apply to it. At an average maximum of 71.4° F. during the day and an average minimum of 51.8° F. at 8 o'clock in the morning, the symptoms of mild mosaic were very distinct. At these temperatures what Prof. M. B. McKay, of the Oregon Agricultural Experiment Station, has designated as super-mild mosaic (distinct slight mottling with no wrinkling or ruffling of the leaf), was plainly visible.



FIG. 159. An index showing rugose mosaic, with extreme ruffling, wrinkling and dwarfing. Mottling or streaking symptoms not visible in photograph.



FIG. 160. Plant of Pride of Wisconsin with symptoms somewhat similar to those of leafroll, but caused by spindle sprout.

It is impossible to hold the temperatures of an ordinary greenhouse constant, but they should be maintained sufficiently low to bring the average down to where the symptoms will show readily. Maximum temperatures may run as high as 80° F., but should not prevail more than two or three hours, if all types of mosaic are to be read easily.

Figures 157, 158 and 159 show the type of healthy plants, and two types of mosaic (mild and rugose), obtained at the above temperatures.

Definite spindle-tuber and leafroll symptoms do not seem to be prevalent in the variety Pride of Wisconsin, and may be disregarded

until further investigation. Fig. 160 is given to illustrate a type of plant obtained that shows leafroll symptoms. No definite symptoms of spindle-tuber were obtained. If constant temperatures of 80° F. could be maintained, more might be learned in regard to it, but as it is not seen readily under field conditions in California it may be assumed safely not to be a factor. If it becomes so, it will be necessary to run a second set of tuber indexes under higher temperatures in order to show proper symptoms.

OUTSIDE INFECTION

Care must be exercised to keep all stock free from insect carriers, such as the aphis. Schultz and Folsom[3] have shown that through genera of aphids, *Macrosiphum solanifolii* Ashmead, *Myzus persicae* Sulz., and *Aphis abbreviata* Patch., transmit virus diseases, so the presence of any aphids will indicate a danger of spreading the disease from plant to plant. If any other plants are present in the greenhouse or if ventilators are not properly screened, plants should be examined every day for these insects and careful spraying done with black-leaf forty if any are found. Fumigation with calcium cyanide is recommended by the United States Department of Agriculture.[4]



FIG. 161. A crop of tuber indexes ready for diagnosis.

CONCLUSION

The value of tuber indexing depends upon the accuracy of the work performed in the greenhouse, final designation as healthy of tubers to be planted and the handling of such stock in the field for increasing to plant larger acreages. This method is being used by the California Department of Agriculture to obtain healthy tubers, and the follow-up work in the field will be as intensive as the greenhouse work. All stock will be planted by the tuber-unit method under its supervision, and carefully inspected during the growing season, as it is realized that proper benefits will not be obtained otherwise from the immense

amount of detail work necessary in tuber-indexing. It is not recommended as a method to be used by the commercial potato seed grower or others, except under expert supervision.

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BUREAU OF FIELD CROPS

L. M. JEFFERS, Chief

IN THE organization of the Department of Agriculture of California those duties and problems relating to the inspection and standardization of field crops and seeds grown or marketed are grouped under the Bureau of Field Crops. The administration of the California Warehouse Act also is an important duty of this Bureau.

The most active functions of the Bureau of Field Crops may be classed as: Grain Inspection and Grading Service, Bonded Warehouses, Seed Inspection and Cotton Classing. Among those activities in the developmental stage are cotton seed certification, hay standards and improved marketing, bean standards and marketing, and the general study of increased use of standards in the marketing of all California field crops.

This work originally was carried on under the Director of Agriculture by authority of the Grain Standardization Act (Statutes 1921, chapter 718); the California Seed Law (Statutes 1921, chapter 693) and the Certified Cotton Seed Act (Statutes 1925, chapter 385). The Grain Standardization Act has been superseded by the California Field Crops Inspection Act (Statutes 1927, chapter 27).

The compulsory labeling phase of the California Seed Law becomes a regulatory function, while all other work performed by this Bureau is optional. Standardization, certification or inspection enterprises, when on a strictly optional basis, immediately require associated educational work to bring them into general use. It is a human tendency reflected in any industry to place relatively high importance on legal freedom of operation. Such resistance as results is worn away by familiarity with the benefits to be derived from a new service and must be accompanied by educational work.

At the close of the year 31 individuals were employed under this Bureau, including four in administration and miscellaneous, fourteen in grain inspection, nine in seed inspection and seed laboratory and four in bonded warehouses.

GRAIN INSPECTION AND GRADING*

Much might be written relative to the buying and selling of grain in California on an inspection system based on correct standards. In previous annual reports and articles prepared by this bureau this phase of marketing has been discussed in detail and will not be repeated again in this summary. However, there is printed elsewhere in this publication an article on "Standardization and Inspection of Field Crops Products" which treats of these topics. It is sufficient to say that in California, unlike most important grain states, the marketing of these commodities is still in the transition period, passing from the obsolete methods of selling on sample alone over to the more satisfactory and efficient system of selling and buying on definitely determined quality.

By the California Field Crops Inspection Act approved April 6, 1927, the Director of Agriculture is authorized to commission any inspector who may issue inspection certificates for those commodities

*Report prepared by R. C. Ralston, Supervising Grain Inspector.

for which state standards are adopted. Under this organization this bureau maintains grain inspection offices at Sacramento, Stockton, Vallejo and San Francisco in charge of bonded and licensed inspectors. Also grain inspectors of the Grain Trade Association of the San Francisco Chamber of Commerce and the Los Angeles Grain Exchange have been authorized by the Director to inspect grain at these two markets. Along with the general grain inspection work it is important also to note that the California rice industry made extensive use of state inspection service in marketing a large part of the 1926 crop as brown and milled rice.

State grain inspection has made gradual progress since 1921 when first it was inaugurated in California, and the past year brought a greater volume to this service than any previous year. Comparisons of certificates issued on a commodity basis are shown in Table 1 for 1925, 1926 and 1927.

TABLE 1—TOTAL GRAIN INSPECTION CERTIFICATES ISSUED EACH MONTH IN 1925, 1926 AND 1927

Months	Corn			Wheat			Oats		
	1925	1926	1927	1925	1926	1927	1925	1926	1927
January	26	65	64	32	20	150			3
February	43	27	86	18	27	126			5
March	37	12	100	1	30	187		1	9
April	11	15	66	14	25	184			8
May	40	91	66	24	39	236			4
June	29	179	66	40	32	122		2	13
July	27	81	67	79	301	488		5	23
August	23	120	36	83	325	435		16	2
September	38	38	65	120	191	346	2	58	1
October	43	76	49	69	162	174		17	6
November	32	127	39	80	269	175		33	2
December	62	52	81	45	136	176	1	15	1
Totals	411	883	785	605	1,557	2,799	3	147	77

Months	Barley			Rice			Grain Sorghums		
	1925	1926	1927	1925	1926	1927	1925	1926	1927
January	1		16	7	185	63	3	20	27
February	5		8	64	293	408	15	5	41
March				36	119	532	8	6	44
April			1	176	112	331		18	35
May		5	2	147	93	169	2	29	27
June	1		13	111	44	265	12	11	28
July	10		33	6	31	95	9	13	13
August		1	8	1	16	1	4	5	14
September		3	38	6	94	24	5	11	16
October		4	22	185	438	399	2	43	63
November	2	1	63	492	446	770	4	73	134
December		2	14	334	377	758	16	33	123
Totals	19	16	218	1,565	2,248	3,815	80	258	565

Months	Beans			Miscellaneous			Totals		
	1925	1926	1927	1925	1926	1927	1925	1926	1927
January					1		69	291	323
February							145	352	674
March							82	168	872
April							201	170	625
May							213	248	504
June					1		193	269	507
July						2	131	431	721
August						1	111	483	497
September					9	1	171	404	491
October				1	1	4	300	741	717
November		1			2	1	610	952	1,184
December	2		11				460	615	1,164
Totals	2	1	11	1	14	9	2,686	5,124	8,279

The number of grain inspection certificates issued each month from each of the state operated inspection offices for the past two years are recorded in Table 2.

TABLE 2—TOTAL GRAIN INSPECTION CERTIFICATES ISSUED EACH MONTH FOR EACH OFFICE IN 1927 AND 1928

Months	Sacramento		San Francisco		Stockton		Vallejo		Total	
	1926	1927	1926	1927	1926	1927	1926	1927	1926	1927
January	187	76	41	21	0	51	63	175	291	323
February	293	202	6	234	0	86	53	152	352	674
March	121	333	2	230	0	89	45	220	168	872
April	113	172	7	172	0	44	50	237	170	625
May	96	101	2	75	0	42	150	286	248	504
June	53	174	6	121	0	74	210	138	269	507
July	35	105	23	81	11	131	362	401	431	721
August	25	12	25	69	46	87	387	329	483	497
September	109	25	40	87	111	39	144	340	404	491
October	444	387	9	58	79	76	209	196	741	717
November	488	756	57	93	110	138	297	197	952	1,184
December	387	674	36	131	56	156	136	203	615	1,164
Totals	2,351	3,017	255	1,372	413	1,016	2,106	2,874	5,124	8,279

COTTON CLASSING

State cotton classing was established first in the Palo Verde Valley in 1923 in response to requests from cotton growers from that area. The service was continued there during the following marketing season, classing offices also being opened at Fresno and Bakersfield. At the two San Joaquin Valley locations this service was maintained for three years, or to the close of the marketing season of the 1926 crop. There were no cotton classing offices operated by this department during the past marketing season.

All indications point to a most important advantage by this service to the cotton grower in each locality, although the use made of it did not justify its continuation by this Department. The most progressive farmers in each area made full use of the service and were enthusiastic supporters, but their efforts alone were not ample to support this activity. Certain economic factors in the cotton industry in this state were instrumental in limiting the demands for state classing. Before the department arrived at a definite decision to abandon this work

cotton growers and bankers were given full opportunity to survey the situation, but they could see no hope of a larger use of the service for the marketing of the 1927 crop.

Those authorities from other localities who are most interested in official grading and classing of cotton as an aid to good marketing have expressed the belief that state cotton classing in California was a basic need to the industry. It seems, however, to have been in advance of the time that the industry clearly could foresee the advantages to be gained through having all cotton classed by a disinterested party rather than selling without knowledge of quality. A further review of the data of cotton classing at Fresno and Bakersfield for the past three years is presented in another article in this publication.

BONDED WAREHOUSES*

The California Warehouse Act is operating primarily to encourage the proper storage of agricultural products, to eliminate unsound practices in warehousing and to facilitate the financing of stored products in a way that will permit orderly marketing.

State bonding of warehouses is optional with the operator, but may be accomplished if the warehousing institution chooses to meet the specific requirements necessary to qualify under this system. When application for license is submitted a preliminary examination is made of the physical condition of the storage house. If this is satisfactory the financial status and reliability of the applicant and the correctness of the title or lease to the property are examined. If these factors are sound the warehouseman files with the state the necessary surety bond and the license is issued. Through the period that the license is in force subsequent inspections and checks of stored commodities and records are made at irregular intervals by the department warehouse inspectors.

The rules and regulations which must be observed in the operating of a bonded warehouse are as simple as consistent with good storage and careful business operation. The utmost care is observed in order that any warehouse receipt issued by a California bonded warehouse may be received as the best possible collateral in financing the handling, holding or marketing of the stored products. The integrity of a warehouse receipt upon which a bank is called to loan money is a matter of first importance and unless the receipt carries the complete security that is implied, the character of the whole transaction is affected.

Bonded warehouse receipts are uniform in terms and can be used by depositors as collateral for loans from any bank. The Federal Intermediate Credit Bank demands bonded warehouse receipts in making loans on agricultural products in storage. The receipts are being used extensively by the largest agricultural commodity marketing associations throughout the state in order to secure large loans at reasonable interest rates from the Federal Intermediate Credit Bank to carry out their program of marketing. The saving to depositors in interest alone is enormous and annually amounts to several hundred thousand dollars. By taking advantage of these better interest rates

*Report prepared by V. O. Wolcott, Supervising Warehouse Inspector.

the commodity need not be thrown immediately on the market at harvest time, but may be supplied more gradually; this ultimately results in much better prices to the producer.

In September, 1925, a cooperative agreement provided for the joint administration in California of the United States Warehouse Act and the California Warehouse Act. This terminated July 1, 1927, and was not renewed.

The past year has shown the greatest demand for the bonding of warehouses since the service was inaugurated in 1921. In Table 3 are recorded the monthly totals of state bonded warehouses for the past two years.

TABLE 3—NUMBER OF CALIFORNIA BONDED WAREHOUSES UNDER LICENSE BY MONTHS IN 1926-1927

Month	1926	1927	Month	1926	1927
January	89	97	July	72	93
February	89	96	August	76	95
March	88	95	September	73	103
April	89	92	October	83	126
May	82	93	November	93	141
June	78	93	December	97	151

From Table 3 it will be noted that during the last four months of the year there was an extensive increased demand for licenses. This increase of 54 new licenses included 18 warehouses for dried prunes and apricots, while the remainder covered largely warehouses for the storage of rice. In Table 4, which follows, are shown the number of houses and the licensed capacity, grouped by commodities as of the beginning and close of the calendar year:

TABLE 4—CALIFORNIA BONDED WAREHOUSES AND COMMODITIES STORED

Commodity	January 1, 1927		December 31, 1927	
	No. of whses.	Capacity	No. of whses.	Capacity
Dried fruit	26	296,850 tons	49	363,750 tons
Grain	55	207,013 tons	84	362,575 tons
Canned goods	15	3,266,000 cases	15	3,529,000 cases
Olive oil	1	76,000 gals.	1	76,000 gals.
Nuts			2	590 tons
Totals	97		151	

At the close of the year there were 46 different companies or individuals licensed to conduct 151 California bonded warehouses. The surety bonds filed with the Department, to secure the faithful performance of obligations, totaled $857,400.

If the licensed capacities for commodities, as shown in Table 4, for December 31, were filled but once during a year, such commodities would equal about $45,000,000 in value, on a farm price basis. California bonded warehouses actually are filling an important place in the marketing procedure of the nonperishable products from the farms.

SEED LABORATORY*

In the administration of the California Seed Law the Department maintains a seed laboratory at Sacramento and carries on inspection work throughout the state. Through the facilities of the laboratory the grower is able to get technical information as to the quality of the seed which he expects to use. Such a service should result in better crops, a partial prevention of the introduction of new weed pests and a reduction in the spread of weeds already found in California. The examination of stocks held by seed dealers already is leading to a more general and careful labeling of seed offered to the public and is a material aid to those growers who are careful in the selection of seed for planting.

The laboratory at Sacramento is maintained cooperatively by the United States Department of Agriculture and the California Department. Such cooperation gives to California interests the benefit of the experience and activities of the Federal Department along with that of this Department and makes possible greater service. All lots of seed imported into the United States through California ports are examined and passed upon by a federal analyst associated with the laboratory in Sacramento.

The services rendered by county horticultural commissioners and the close relations maintained by these commissioners with the Department make possible a more local service to the growers. The seed inspection service maintains definite working arrangements with fourteen of these commissioners. There actually were submitted in 1927 by horticultural commissioners only 125 samples from 23 counties, but a conspicuous increase in such work is certain to develop. These men, through such cooperation, are able better to enforce certain quarantine regulations and also to give greater protection to purchasers of seed.

In the operation of the seed laboratory certain activities are along investigational lines, but more properly may be classed as developmental work. During the year there were 538 samples handled which were classed as investigational. There are many problems presented in connection with laboratory and enforcement work which require special study.

One of the major weed problems of the state is the control of puncture vine. In cooperation with the Bureau of Plant Quarantine and Pest Control and with the horticultural commissioners a large number of puncture vine seeds were tested in connection with various methods of treatment used for the control of this weed pest. Also a study is being made of the quality of vegetable seeds distributed through small packets. Out of a total of 396 packets, selected at random, about 15 per cent were found worthless for planting purposes. The data secured on one year's study can not be conclusive in work of this character and the collection and testing of such samples will be continued. In cooperation with several of the seedsmen in the state, study also is being made of the viability of flower seeds held under ideal storage conditions.

During the year there was a total of 4283 samples received at the laboratory. These were from 616 different sources, including individual farmers, seedsmen, cooperative agencies and official inspectors.

*Report prepared by W. S. Wilkinson, Jr., Seed Specialist.

In addition to the above indicated number there were 134 samples of seed handled in the laboratory, which were taken from lots imported into the United States through California ports. Although the total number of samples handled showed an increase over 1926 receipts of only 3.6 per cent, the volume of work was increased in a greater proportion, due to the fact that there was an increase of 9.8 per cent in the amount of purity work performed.

The samples received in the laboratory are divided into three groups, namely: public service, fee samples and inspection and investigation. In accordance with the regulations there is a limit of 10 individual tests per year free to each person or firm, additional tests being charged for in accordance with an established fee. An individual test may be for purity, germination, examination or identification. Any combination of these individual tests may be obtained, but the basis for calculation is on number of tests and not on number of samples. Table 5 gives in detail data relative to the classification of samples and the character of work performed.

During 1927, 1596 fee samples were handled, yielding a revenue of $1,732. During 1926 a revenue of $2,000.90 was received for the handling of 1995 samples. The reduction in volume of fee samples is the result of the establishment of a commercial seed laboratory in Los Angeles and increased testing in the laboratories of the larger seed houses. During the year 2207 inspections were made by the Department. In this work 346 inspection samples were secured representing 25 different kinds of seed. It has been possible slightly to increase the inspection work, and more extensive and complete labeling is resulting, with a decrease in the percentage of incorrect labels.

Under the statutes a certain lot of seed may be labeled in accordance with the provisions of the law, and yet, due to the large tolerance legally permitted, seed containing noxious weed seed may be bought. The grower is not expected to be thoroughly familiar with the technical provisions of the law, although he is justified in expecting certain protection from it and the expenditures of state money in enforcement work. Careful consideration of such points in the present law should be given by growers and dealers in order that the seed industry of the state may be protected properly.

It was necessary to proceed with court action in four cases. In three of these the defendant plead guilty and the court assessed fines which were suspended. One trial, due to a technicality, resulted in a verdict of not guilty. This particular case emphasizes the need in the law of special provisions based on quarantine principles which would enable the state to protect growers and dealers against shipment into the state of seed which can not be governed by the provisions of the present law. The seed industry of the state should enjoy all possible legal freedom, but, above all else, the planter must be given the most useful information possible, as on the success of the farmer will depend the success of the distributors and other associated business activities.

TABLE 5— A. CALIFORNIA COOPERATIVE SEED TESTING LABORATORY RECORD OF SAMPLES RECEIVED AND TESTS CONDUCTED BY MONTHS FOR 1927 AND (B) RECAPITULATIONS FOR 1926 AND 1927

	Total					Public Service					Fee					Investigation and Inspection				
	Total	Purity	Germination	Identification	Examination	Total	Purity	Germination	Identification	Examination	Total	Purity	Germination	Identification	Examination	Total	Purity	Germination	Identification	Examination
(A)																				
January	356	147	249	2	94	185	103	163	2	6	111	31	73	0	42	60	13	13	0	46
February	279	141	206	3	59	130	85	117	3	3	111	19	53	0	56	38	37	36	0	0
March	390	175	360	1	6	172	102	156	1	4	178	46	172	0	2	40	27	32	0	0
April	309	287	256	1	10	144	117	98	0	8	106	80	100	1	2	59	40	58	0	0
May	138	92	109	3	6	83	45	61	3	6	34	26	28	0	0	21	21	20	0	0
June	709	83	670	7	15	104	54	83	6	4	62	20	48	1	11	543	9	539	0	0
July	220	61	199	7	7	125	31	113	5	6	86	21	77	2	1	9	9	9	0	0
August	286	154	261	7	9	106	65	93	4	3	115	46	103	3	6	65	43	65	0	0
September	396	274	376	1	4	154	112	144	0	0	181	101	171	1	4	61	61	61	0	0
October	402	252	386	3	4	180	135	169	3	2	174	69	169	0	2	48	48	48	0	0
November	490	361	465	7	2	195	156	184	5	0	271	181	257	2	2	24	24	24	0	0
December	308	199	279	7	8	125	91	104	6	5	167	93	160	0	3	16	15	15	1	0
(B)																				
Total receipts, 1927	4,283	2,176	3,816	49	224	1,703	1,096	1,485	38	47	1,596	733	1,405	10	131	984	347	920	1	46
Forwarded, January 1, 1927	214	91	212	0	0	35	32	35	0	0	59	59	57	0	0	120	0	120	0	0
Total to test in 1926	4,497	2,267	4,028	49	224	1,738	1,128	1,520	38	47	1,655	792	1,462	10	131	1,104	347	1,040	1	46
Forwarded, January 1, 1928	37	35	37	0	0	3	3	3	0	0	2	0	2	0	0	32	32	32	0	0
Total samples tested in 1927	4,460	2,232	3,991	49	224	1,735	1,125	1,517	38	47	1,653	792	1,460	10	131	1,072	315	1,008	1	46
Total receipts, 1926	4,133	1,981	3,710	98	78	1,697	1,066	1,463	58	19	1,995	725	1,850	5	59	441	190	397	35	0
Total samples tested in 1926	4,012	1,960	3,567	121	78	1,687	1,059	1,452	58	19	1,951	681	1,808	5	59	374	220	307	58	0

THE GRADE AND STAPLE OF CALIFORNIA COTTON

By R. E. Blair, Assistant Chief, Bureau of Field Crops.

AMONG the many specialty crops of California are found not only those that succeed in certain areas alone, due to peculiar climatic requirements, but also some of the important world crops that as grown in this state have become specialty crops. Cotton is one of this second group, for California cotton has qualities that have yielded better prices to the producer than are common to that vast area of the United States where it largely is grown. Such qualities must be upheld if the California cotton grower can successfully compete with these other extensive areas where land values and operation costs are lower.

With the realization of these facts various special methods have been practiced to maintain prosperity for the California cotton grower. Among these, state cotton classing has been of considerable consequence, for it is equally as important to sell this crop well as it is to provide essential quality. Even though cotton culture has been surrounded by all the best technique of the industry, including the use of good seed, the establishing of one-variety areas, the application of the best cultural practices and the performance of correct ginning, still differences in the value of the fiber will occur from one farm to another and between areas in the same field. Such differences of fiber quality, involving staple, grade and character, determine the actual worth to the cotton mill. Under ordinary field buying conditions, buying may or may not be definitely discriminative of such qualities, but during the concentration of shipments to the mills bales of cotton are sold eventually on true value, premiums being paid for quality and penalties placed on inferior lots. It is important that the grower who is endeavoring to produce a superior quality be paid the premiums to which he is entitled, for only in this way can he survive in the industry.

The direct and indirect values of an official cotton classing service are not limited alone to the marketing of the commodity. During the past three years this Bureau has maintained two offices in the San Joaquin Valley, where all counties were included in a one-variety zone and were producing relatively large amounts of Acala. Supplies of good seed each year were more generally available for planting and growers were making an effort to improve cultural practices on the basis of accumulated experience. Denied the state cotton classing service, these factors of progress were without a tangible measure to gauge advancement, inaction or recession.

It is with the thought of such an analysis that the summary of the past three years' results of these two classing offices is presented here. The data included in tabular form relate to all cotton classed at the Fresno and Bakersfield offices and are segregated on a basis of areas of origin. This grouping is used because the areas roughly are similar in production conditions and may furnish useful comparisons among groups. The reader should be mindful, however, that the total number of bales included in some of these groups is probably not sufficient to reflect true differences of the average cotton from such areas.

It ordinarily may be accepted that the output of any cotton gin in the San Joaquin Valley is grown within the local radius of such a gin. The groups as adopted include cotton ginned at the following points: (1) Western Merced County—bales from Los Banos and Dos Palos; (2) Madera County—from Chowchilla and Madera; (3) Fresno County—from Firebaugh, Mendota, Kearney, Fresno and Helm; (4) Kings County—from Corcoran; (5) central Tulare County—from Tulare, Tipton, Porterville and Poplar; (6) southern Tulare and northern Kern—from Earlimart and Delano; (7) central Kern County—from McFarland, Wasco, Pond, Shafter and Rio Bravo; (8) Weed Patch area, Kern County—from Edison, Lamont, Weed Patch and Arvin; (9) Kern Lake area, Kern County—from Kern Lake and Connor Station; (10) unidentified origin—includes mostly those bales sampled at cotton compresses at Fresno, Bakersfield or San Pedro and also a small number of bales from other cotton valleys in the state.

In reviewing the staple determinations of the seasons of 1924, 1925 and 1926 it should be understood that Acala cotton has been bred and selected to produce fiber 1⅛ inches in length, when well grown. Under broadly scattered plantings on different types of soil and with varied water supplies, much of this cotton, when even fairly well grown, actually produces a staple of $1\frac{1}{16}$ inches. Desirable soil, thorough and timely irrigation applications and good farming practices, along with good seed, should produce fiber of a staple of these two commercial lengths. Only a very limited amount of the full $1\frac{3}{16}$-inch staple is produced from the present developed strains of this variety. There was not even 1 per cent of the total of this class produced in any year.

In 1924 only a part of the Acala seed available for commercial plantings in the San Joaquin Valley was known to be especially good. In contrast, in the spring of 1925 and 1926 large amounts of good seed were available. It will be observed that the comparative amount of cotton with staple less than $1\frac{1}{16}$ inches has decreased from about 10 per cent of the total in 1924 to 6 per cent in 1926. Also in 1925, the first year that good seed was available abundantly, there was a most conspicuous increase over 1924 in the proportionate amounts of 1⅛-inch staple. A brief review of the climatic conditions of the autumn and winter of 1925 will show the excessive and continuous fog and damp weather that prevailed, many fields going through the winter with much unopened cotton. In order that this unfortunate condition would not recur the following year, many cotton farmers restricted late summer or autumn irrigations. For many fields this treatment proved desirable, but for others having lighter soils, the result was an early drying out, bringing prematurely opened bolls lacking in fiber length. Therefore it can be appreciated clearly that even with irrigation and without the major cotton pests the cotton price is not the only unknown factor with which the California cotton farmer is confronted.

Those interested in cotton improvement have labored most earnestly for the improvement or at least the maintenance of fiber of good character and desirable uniform staple. These are the qualities requiring the greatest time and technique in order to acquire desired perfection and stability. Experience has proved, however, that the value of fiber on the market likewise is established on grade, a descriptive synonym for color and freedom from foreign matter. This quality is of great

PERCENTAGES OF STAPLES OF SAN JOAQUIN VALLEY COTTON PASSING THROUGH STATE CLASSING SERVICE, CROP YEARS 1924, 1925 AND 1926

	Locality where produced										
	Western Merced County	Madera County	Fresno County	Kings County	Central Tulare County	Southern Tulare and Northern Kern Counties	Central Kern County	Weed Patch, Kern County	Kern Lake, Kern County	Unidentified Origin	Season's Total
Season of 1924											
Number of bales classed		67	4,128	107		219	2,637	4,320			11,778
Per cent was											
7/8" staple			2				5	5			3
1" staple		19.4	14.3	13.1		1	12.2	3.4			9.6
1 1/16" staple		80.6	72.8	84.1		66.2	60.8	70.2			69.2
1 1/8" staple			12.6	2.8		33.3	23.7	25.9			20.2
1 3/16" staple			1				2.8				.3
Season of 1925											
Number of bales classed	139	678	1,927	1,012	999	532	1,504	3,536	1,716	331	12,401
Per cent was											
7/8" staple								3			1
1" staple	3.7	4	1.2	.8	2	7	1.5	1			.6
1 1/16" staple	83.8	46.3	66.2	23.6	51.0	28.8	14.6	19.2	72.2	44.4	32.6
1 1/8" staple	12.5	52.4	32.1	75.6	48.8	70.5	83.9	80.4	27.8	54.7	59.6
1 3/16" staple		.9	.5							.9	.1
Season of 1926											
Number of bales classed	74	414	2,509	238	460	571	182	1,955	424	418	7,245
Per cent was											
7/8" staple										6.2	.3
1" staple			1.9	2.5		12.1		3.1	.2	55.0	5.8
1 1/16" staple	62.2	20.5	64.2	87.4	13.5	44.8	6.1	25.7	63.7	25.6	43.6
1 1/8" staple	37.8	76.6	33.8	10.1	86.5	43.1	93.9	71.2	36.1	12.2	50.1
1 3/16" staple		2.9	1							1	.2

PERCENTAGES OF GRADES OF SAN JOAQUIN VALLEY COTTON PASSING THROUGH STATE CLASSING SERVICE, CROP YEARS 1924, 1925 AND 1926

	Locality where produced										Season's Total
	Western Merced County	Madera County	Fresno County	Kings County	Central Tulare County	Southern Tulare and Northern Kern Counties	Central Kern County	Weed Patch, Kern County	Kern Lake, Kern County	Unidentified Origin	
Season of 1924:											
Number of bales graded		67	4,428	107		219	2,637	4,320			11,778
Per cent was:											
St. Good Mid.			.5				.8	1.6			.9
Good Mid.		17.9	19.7	36.4		50.7	28.1	34.7			27.8
Strict Mid.		50.7	40.6	43.0		31.1	63.6	40.7			45.7
Middling		31.4	25.9	13.1		4.6	5.6	12.8			16.1
St. Low Mid.			11.5	7.5		3.6	.9	7.4			7.4
Low Mid.			1.7			8.2	.1	1.8			1.5
St. Good Ordinary			.1			1.8	.1	.1			.1
Below St. Good Ordinary							.8	.9			.5
Season of 1925:											
Number of bales graded	136	678	1,927	1,012	999	532	1,504	3,536	1,746	331	12,401
Per cent was:											
St. Good Mid.											
Good Mid.		.9	.9	6.4	11.1	41.5	12.9	3.5	2.2	6.9	6.4
Strict Mid.		26.0	23.8	34.7	46.3	34.0	34.7	31.4	33.3	31.4	31.8
Middling	14.7	44.8	49.3	43.0	27.7	19.6	33.4	40.3	39.3	36.0	38.8
St. Low Mid.	38.2	22.6	24.6	15.4	12.9	4.3	15.0	22.1	23.4	21.7	20.0
Low Mid.	35.3	5.6	1.3	.5	2.0	.6	3.9	2.7	1.8	4.0	2.7
St. Good Ordinary	11.0	.1	.1				.1				.2
Below St. Good Ordinary	.8										.1
Season of 1926:											
Number of bales graded	74	414	2,509	238	460	571	182	1,955	424	418	7,245
Per cent was:											
St. Good Mid.							2.8	.5		.5	.2
Good Mid.	9.5	7.0	8.6	11.3	44.2	20.6	46.1	43.8	31.4	15.8	24.0
Strict Mid.	37.8	50.7	47.0	66.0	42.2	52.0	36.8	34.4	26.2	39.7	42.5
Middling	4.0	18.3	35.8	22.3	4.1	23.8	8.8	11.8	23.1	25.1	22.5
St. Low Mid.	5.4	22.3	7.9	.4	5.4	3.0	5.5	9.0	18.6	18.2	9.4
Low Mid.	31.1	1.7	.6		4.1	.6		.5	.7	.7	1.2
St. Good Ordinary	12.2		.1								.2
Below St. Good Ordinary											

importance in the marketing of California cotton, as has been recognized by the adoption of extra white standards for southwestern cotton.

The factors that go to produce good grades are more a matter of careful harvesting and ginning than of good soil, seed and culture. Climatic conditions during periods of maturity and harvest also go far toward determining resultant grades. By reviewing those data showing grade determinations the reader will observe that seasonal harvest conditions directly affected the three crops involved in this table. The autumns of 1924 and 1926 both were exceedingly favorable for cotton maturity and harvest in the San Joaquin Valley. Rains, fogs, high humidity and low temperatures did not set in until quite late, so that cotton could be harvested while dry and without stains from moisture, permitting of good ginning and resulting in good grades. The autumn of 1925 was much inferior in all of these factors and resulted in a larger percentage falling into lower grades. It will be observed that in 1924 about three-quarters of all cotton graded was equal or superior to strict middling. In 1925 less than two-fifths was of similar grade, while in 1926 more than two-thirds of the cotton classed was strict middling or better.

In each area there were conspicuous differences between the work done by certain gins. Those ginners who made a special effort to show a high lint out-turn often produced many bales of low-grade fiber due primarily to badly adjusted machinery, poor workmanship or to ginning the seed too close purposely. While a greater out-turn resulted from close ginning, the grade often was so severely reduced that the net result was not only a loss on this particular lot of cotton, but also brought to the locality or gin a reputation, among buyers, for low-grade cotton, which often extended over future seasons. It was evident in many such cases that field buying was not discriminative and did not establish the proper price differentials between such gin cut cotton and cotton of better quality.

The state classing service often was found distinctly beneficial in convincing the grower in time for the difficulty to be corrected before more was damaged that his cotton had been injured by inferior ginning.

The state cotton classing service was discontinued at the close of the marketing season of the 1926 crop. This service, like other similar commodity services, was expected to become self-supporting, but it became evident that the growers were not maintaining their earlier demand for service and the Department was forced to discontinue it until such a time as these demands might be resumed. It is difficult to identify all the factors bringing about this condition, although it is evident that the low prevailing prices for the 1926 crop and the rather complicated financing methods of 1927 had their influence. It is the hope of this Department that California cotton growers may maintain the present high standards and market their commodity successfully, whether by the aid of state inspection or the use of private sales agencies.

BUREAU OF PLANT QUARANTINE AND PEST CONTROL

W. C. JACOBSEN, Chief

INTRODUCTORY

EACH YEAR BRINGS new responsibilities in regulatory work which may come from requests of agricultural industries directly, or through the medium of the State Legislature. Three important new projects appeared during 1927. Apiary inspection and authority to more adequately handle weed infested commodities came through legislative action, while the third, fig endosepsis control, came through a request from the growers direct.

APIARY INSPECTION

California has long been recognized as an important honey producing state and also for its development of the package bees and queens business, but our beekeeping industry suffered from restrictions placed by other states because of American foulbrood and also because of lack of coordinated state-wide legal authority to handle the clean-up of this disease. Consequently, progressive leaders in the industry petitioned the State Department of Agriculture to assist in formulating legislation which would unify and coordinate inspection methods with the end in view of eradicating American foulbrood and other diseases of consequence, and incidentally, to facilitate the interstate movement of bees and commercial products of the apiary without burdensome restrictions. The industry specified a type of legislation desired and in consultation with the department prepared the act which subsequently became law.

The provisions of the law decreed that the director of agriculture should administer the quarantine provisions relative to movements of bees, both interstate and intrastate, and that the county horticultural commissioners should be ex officio state bee inspectors. No funds were appropriated by the legislature for this work in the State Department of Agriculture, and this was the case also with the budgets in the counties. However, admirable progress has been made in organizing the apiary inspection work, sometimes at the expense of work already provided for, and in other instances by slight additions to the budgetary allotments in some counties.

It was determined that the majority of beekeepers were in favor of drastic eradication measures against foulbrood; that this disease had been tolerated too long; that eradication was exactly what they had in mind, and that the provisions of the act set forth their views in very definite form.

A qualified supervisor for the apiary work was found among the employees of the bureau and set to work. His experience in other states showed that an intensive area clean-up program could well be a first step if any appreciable inroads against American foulbrood were

to be made. A registration of apiaries indicated that there were probably 300,000 colonies in the state. Late in 1927 specific areas were lined up for accomplishments during 1928 and at this time there seems to be no sufficient reason why California can not become known as an area free of American foulbrood, just as it is known as a honey producing area of great importance.

WEED CONTROL LEGISLATION

The program to control puncture vine in California was embarked upon several years ago when it was realized by growers and farm organizations that this weed pest was of vital concern to the agricultural progress of the state. Puncture vine is spread by automobile tires and railroad cars, thereby infesting county roads, state highways and railroad rights of way, from whence it is carried into other uncultivated areas and farmed lands.

Satisfactory control methods were developed through the use of a Diesel oil spray upon uncultivated areas where it was used extensively. In 1927 the results obtained after two years of intensive operations in many of the counties, indicated that success would be attained if the methods employed were consistently continued. Some counties were equipped with low pressure sprayers of a type suitable for puncture vine oiling and funds amounting to approximately $250,000, including costs of oil and work of all agencies, were expended.

The oil spray for controlling puncture vine on uncultivated areas was not applicable on tilled ground, and hence special encouragement had to be given control measures on farming lands, particularly alfalfa fields. The part played by agricultural commodities in spreading puncture vine seed became one of primary consequence, whereas, in all previous considerations this subject had been relegated to second place. Prior to July, 1927, there was no authority to hold hay, straw, manure, fertilizer, and similar commodities, therefore legislation was drafted to make it possible to curb spread through materials of this sort. The legislature provided Political Code section 2323 to permit the holding of infested commodities on the ground without moving until released by the Director of Agriculture or the county horticultural commissioner, and provided further that any commodities either entering or being shipped within California found infested with the seed of uncommon noxious weeds were subject to rejection unless cleaned to the satisfaction of the enforcing officer at destination.

A survey of the state revealed a considerable acreage of growing alfalfa more or less infested. It was found that while alfalfa fields did not present a severe hazard themselves the manner of cutting and raking the hay brought puncture vine in from ditch and check banks adjacent to the plantings. Therefore, a more intensive application of control measures by cultivation within agricultural plantings to suppress the possibility of further spread by hay, straw, cottonseed, melons, potatoes, etc., has been inaugurated. Whether or not these provisions will be of the value anticipated in stemming the spread of the more important noxious weeds can better be determined with the passing of another growing season.

FIG ENDOSEPSIS

A reduction in the tolerance in dried figs, to 10 per cent of all defects permissible, by the United States Food, Drug and Insecticide Administration militated seriously against the ready handling of dried Calimyrna figs in interstate commerce. One of the chief defects was caused by the development of an internal rot or endosepsis during the growing period which in grading was classed as a type of souring. This affection had been known for a number of years and had caused increasing losses, rendering whole crops from some orchards unfit for normal marketing. Many growers credited the unsatisfactory prices received to the endosepsis affected figs. The main need seemed to be for a practical control method.

In anticipation of the need for control of this disease, legislation was started in 1927 providing for destruction of infected figs, but before gaining much headway it was found, in consultation with the Department, that adequate authority already existed with which to effect a control. A cooperative program on the part of fig growers, using methods in the process of completion by the University, seemed to afford a better solution.

Investigational work at the University demonstrated that the blastophaga, a minute wasp, definitely necessary for the caprification of the fig crop, was responsible for the transmission of the infection from one crop to the next on the capri trees. This infection finds its way to the Calimyrna crop during caprification. And in the vicinity of capri trees even Adriatic and Black Mission figs were affected, often appreciably, hence, growers of these crops were also concerned. It was determined at the University that by proper disinfection of the mamme crop of capris the infection could be suppressed long enough to prevent carriage of spores by the wasp.

After thorough investigation representatives of the fig industry demanded that the State Department of Agriculture, the horticultural commissioners, and the College of Agriculture assist in a basic state-wide campaign to eliminate endosepsis infection. Cooperation of these agencies was granted with the understanding that the campaign would be conducted by the industry with the public agencies helping wherever possible. The suggestion that the plan be tried out on a small area, probably on a county-wide basis, to determine the effectiveness of the method on a commercial scale, did not meet with approval from industry representatives. The more manifest opinion was that the losses would never grow less, and the prospect of a short crop or even none at all, with a good percentage (60 per cent or better) of endosepsis eliminated, would be worth considerably more than a crop of the type anticipated with the disease still unchecked.

With the insistence that it be undertaken on a state-wide basis, the following general program was outlined and approved at the Eleventh Fig Institute at Fresno in November:

1. That all capri fig trees in California be located by survey of the county horticultural commissioners, assisted by fig growers.

2. That following this survey steps be taken to remove the mamme figs, which crop not only harbored the blastophaga but also at that

season of the year the only known source of endosepsis infection. This mamme crop represented the one vulnerable point in the cycle of the disease.

3. All mamme figs thus removed and collected to be shipped to a central storage place for holding until proper time for disinfection.

4. All mamme figs in storage to be split open at time of blastophaga maturity.

5. These figs to be dipped in a disinfecting bath to inhibit endosepsis growth for a sufficient time to permit emergence of blastophaga without carrying its spores.

6. The disinfected figs to be incubated to hatch out blastophaga quickly.

7. The wasps to be collected in tubes of a size suitable to hold from 350 to 500.

8. The tubes containing these blastophaga to be returned to the orchard from which the mamme figs had been removed, in order to populate the profichi crop. From that point on the cycle was normal.

The experimental work indicated this program to be entirely feasible and plans were at once formulated for making the survey and for gathering the mamme figs. This part of the program was to be the primary responsibility of the State Department of Agriculture and the county horticultural commissioners. It was considered desirable to create county committees in the important fig producing counties and to secure whatever assistance was necessary in other counties from representatives of the California Peach and Fig Growers Association and the Dried Fruit Association of California, which two organizations also agreed to underwrite those expenses which could not be otherwise met.

At the close of 1927, plans had been perfected for making the survey. The outcome of the campaign remains to be seen and perhaps can best be determined with the harvest of the 1928 Calimyrna crop.

PLANT QUARANTINE

The finding of Mexican fruit fly, *Anastrepha ludens*, in Texas, and the extension of pink bollworm of cotton, *Pectinophora gossypiella*, into Arizona, brought considerably closer to California the hazard of two major insect pests which, if they gained entrance into California, would present a decided menace and loss to the citrus and cotton industries, both of which are of exceeding importance to the agriculture of the state.

The Department, in order to be fully informed with reference to the Mexican fruit fly situation in Texas, detailed an entomologist to make a survey of conditions and to report the facts. This will be the subject of a special report appearing in a later issue of the MONTHLY BULLETIN.

Pink bollworm control in Arizona has been undertaken by the Federal Horticultural Board and restrictive measures instituted to prevent further spread and to prohibit the movement of infested cottonseed or other dangerous cotton products in interstate commerce. Border inspection work for vehicular traffic and intensive destination inspection of commodities moving into California is, however, of vital importance.

There has been a constant increase in the volume of materials and carriers subject to plant quarantine inspection. A 25 per cent increase has been noted in automobile travel through the border stations, and larger passenger lists on steamships plying between the Hawaiian Islands, the Orient and California's ports.

A simplification of California's quarantine orders and circulars became desirable as a result of the United States Supreme Court decision rendered in March, 1926, which nullified the basic quarantine legislation of states whose enactments were passed prior to the creation of the United States Plant Quarantine Act in 1912. Our basic quarantine legislation was enacted prior to the passage of the above act, but our orders were considered as being in a doubtful position, and for that reason were revised, giving us now twelve basic state quarantine orders and seven quarantine circulars, the latter based upon the state quarantine law.

CITRUS WHITE FLY

New infestations of citrus white fly were found during the year at Oroville, in Butte County, and at Ontario, San Bernardino County. A constant search for indications in Oroville had been made during the past two years, but white fly was not actually found until the summer of 1927.

The infestation in Southern California was important, indicating the readiness with which this pest might be transported on host plants escaping the attention of inspection officials if not properly marked and reported by the carriers. A shipment of Cape Jessamine plants out of one of the southern states was located by the accidental report of another party, whose receipt of similar plants from the same place was refused by a Los Angeles County inspector. Inquiry revealed that the plants at Ontario had been received without report from the postmaster, the package not having been specifically marked "plants," and had been planted. The receiving party defoliated the plants with the exception of one, upon which three infested leaves were found. The plants were received after white fly would normally be dormant, and were discovered before any possibility of emergence. Both defoliation and time of year were aids in preventing spread. However, as a safeguard measure, the area, including thirty surrounding blocks in the city of Ontario, was intensively sprayed and the original plants destroyed.

The campaign against citrus white fly in northern California has proceeded with good effect. With a more experienced organization it has been possible to shorten the program for the winter of 1927–1928. The demonstrated effectiveness of the work indicates the necessity for its continuance.

A special report in this bulletin covers this subject in detail.

DICTYOSPERMUM SCALE

With the determination by Chamberlin* of the synonymy of Dictyospermum scale found in California, Florida and the Mediterranean, and because of shipments of *Cocos plumosa* palms from Florida, a

*MONTHLY BULLETIN, California Department of Agriculture, Vol. XVI, No. 9, p. 485.

renewed interest appeared in the matter of controlling this scale insect even to the extent of requesting a quarantine against all states in the United States where this insect was known to exist out of doors. However, since it is known to be present in at least thirty nurseries in California, probably also on plants in florists' shops and used in lobbies of buildings and hotels for ornamental purposes, it was believed that a quarantine was not fully advisable. In California this scale has not been found except in greenhouses or under lath, no infestation ever having been found out of doors. As a result of conferences with growers' organizations it was concluded that the best determination as to the advisability of quarantine could be made only after sending a representative to Florida to better learn its status as pest carried by nursery stock and its potentialities as a citrus and avocado pest.

AUSTRALIAN TOMATO WEEVIL

The presence of this insect has called for a dual program (1) to prevent spread into new areas and (2) to establish satisfactory control practices.

In order to provide adequate regulatory provisions to curb further distribution, the extent of infestation, together with the kind and number of host plants, had to be determined. This has been done intensively by the Department in cooperation with horticultural commissioners, none of the other organizations concerned with insect pest control having facilities available which would be of material assistance. Special attention was paid to sprays and baits of practical use in control. Those found have shown good results, but it is believed that even better control will be accomplished with a continuance of investigations.

CITROPHILUS MEALYBUG

To insure greater uniformity in the enforcement of the nursery stock inspection provisions to prevent spread of citrophilus mealybug into clean areas, nurserymen, growers, and county horticultural commissioners requested the Department to undertake the promulgation of a definite ruling. A regulation, limiting the extent to which presumption of infestation at origin could be cited, became effective March 11, 1927. What constituted an area of infestation was brought down to the boundaries of the nursery, and the method of determining infestation was outlined.

The regulation encouraged several nurserymen to intensify on mealybug eradication because their own clean-up efforts would be the basis of their ability to ship stock into clean areas without the handicap of being inhibited in this because of surrounding infestations in orchards or home gardens.

It seemed desirable to provide a list of nurseries in which citrophilus mealybug was not known to exist, rather than continue the practice in some counties of maintaining a list of nurseries in which there was reasonable cause to presume infestation existed.

BULB TREATMENTS

While progress is indicated in the control of the two major pests of narcissus bulbs, nematode and bulb flies, under the ruling now in

effect, there are some growers inclined to believe that its further modification is desirable. To temporize with control measures because of trade conveniences delays the day of possible eradication. While complete eradication is, perhaps, unattainable, an intensive systematic control would prove of benefit to the bulb industry by consistently lessening infestation.

There was some complaint of the hot water treatment being cumbersome and some slight damage by vacuum fumigation tended to discredit this method. One grower in seeking an easy way to treat bulbs tried out various disinfecting solutions with the result that none of the pests was curbed, and it was found that the methods prescribed in both federal and state rulings gave the most satisfactory results.

Investigations by the federal bulb insects laboratory at Santa Cruz indicated the possibility of calcium cyanide dust serving admirably as an additional method to suppress bulb fly. These investigations may prove it a method to be substituted for vacuum fumigation to eliminate bulb flies.

RODENT CONTROL

An interesting occurrence developed early in January when hordes of mice were discovered migrating from the Buena Vista Reservoir in Kern County. This phenomenon was reported to the State Department of Agriculture by the local horticultural commissioner, who sensed need for a drastic control program. The rodents seemed to be chiefly house mice interspersed with a percentage of meadow mice. The outbreak was unusual in that it is generally the latter which is prone to go on migrations of this sort when their population becomes abnormally large. Nearly every year in California in some section a meadow mouse plague may occur, though rarely in as great numbers as the Kern County migration.

The horticultural commissioner petitioned the aid of the state and federal departments of agriculture in suppressing this infestation, and the work was organized with the United States Biological Survey, the State Department of Agriculture, county horticultural commissioner, the county board of supervisors, the land owners, and the oil companies cooperating fully.

A great deal of publicity was given the matter, largely due to the fact that the invasion reached the city of Taft, causing considerable annoyance. There seemed to have been several waves of migration, although the one in January, because of its severity, engaged primary attention. The cause of the outbreak seemed to be chiefly lack of food due to harvesting of the cultivated crops in the Buena Vista Reservoir bed. An abundant food supply before the harvest had served to greatly augment the already heavy population present at the beginning of the 1926 crop season.

The first work to control this outbreak was done through the cooperation of the oil companies and the county, when seventeen miles of trenches were dug, into which poisoned grain was placed. This helped check the spread into places of human habitation, but it was obvious that unless the source was cleaned up there was possibility of even further and greater migrations. Mr. S. E. Piper of the United States Biological Survey, experienced in plagues of this sort, happened to be

in the state, and assisted materially in developing methods and in organizing a program. A large crew of men supplied by land owners in the vicinity, aided by county, state and federal men working under a trained supervisor, was placed in the field. A camp was established before the end of January to care for these crews. Seventeen thousand acres, nine thousand of which were maize and barley stubble and eight thousand uncultivated, were poisoned with steam rolled barley strychnine coated at the rate of one ounce of strychnine to 30 quarts of grain. The main body of the reservoir was poisoned by men afoot covering approximately one thousand acres per day. The edges and the follow-up spot work were taken care of on horseback. Barns and granaries in the lake bed or in the vicinity were treated with calcium cyanide dust.

Within two weeks after the operations started, the poisoning had shown a very telling effect upon the population. Toward the end of the poisoning campaign a disease broke out among the mice which further aided in eliminating them. At the end of the poisoning operations many acres were found entirely devoid of mice.

A special report on the mouse outbreak is to appear in one of the future issues of the MONTHLY BULLETIN.

In ground squirrel control it is conceded that the older methods, utilizing strychnine coated grain and carbon bisulphide gas, still remain good during certain periods of the year, but do not result in complete elimination of squirrels in spite of their general use. With the development of thallium sulphate and kindred salts of this element, it is believed that a three-way control program can now be suggested, utilizing thallium as a poison on grain at a season when the other methods are not fully effective. This material will not supplant the other methods but rather will supplement, filling a place where the other two have their limitations. Thallium treated baits have only a seasonal use. The nature of this material is such that the recommendation of the Department is that only official agencies shall handle the material and supervise its application. Continued study of food habits by the United States Biological Survey will serve to improve control practices. This study is vitally needed.

NEW WEED

Aegilops triuncialis, a weedy grass which appears to have a noxious nature, especially in crowding out good forage plants on the range and pasture lands, was reported from Calaveras County. Reports that in cases it has caused injury to live stock in the same manner as foxtail and broncho grass have not been verified. As it was found too late in the season, no control measures were instituted on the two hundred odd acres reported, though its habit of appearing green after other forage is dry will facilitate finding. The policy of intensive suppression of a new weed will be followed in cooperation with the county and growers to prevent the establishment of just one more worthless plant.

In general, a far greater interest has developed in weed control and this important phase of agricultural pest control will undoubtedly assume its proportional place. Educational work seems to be the chief need.

EXAMINATIONS

Since the Department has been charged with the duty of qualifying county horticultural commissioners, deputy county horticultural commissioners and county horticultural inspectors, there has been an obvious need for a special grade for deputy county horticultural commissioner. This has been accomplished by revising the rules and regulations, making it necessary for candidates to receive an appreciably higher rating, 85 per cent and above, in the oral quiz to be eligible for county horticultural commissioner, as against 70 per cent to 85 per cent for deputy county horticultural commissioner. The written examination is the same for both positions. Persons holding a deputy's certificate of eligibility need take only the oral examination at a succeeding test to qualify for a commissioner's certificate.

PERSONNEL

The viticulturist for the department resigned early in the year, making it necessary to redistribute his activities in such a way that the department could absorb them in its various functions. To this end the Bureau of Plant Quarantine and Pest Control took over the phases pertaining to entomology and plant pathology.

The office of the superintendent of rodent control experienced a change during the year and a little later the position of botanist was vacated, due to resignation. The practical phases of rodent and weed control were combined under one supervisor.

The field entomologist joined the ranks of county horticultural commissioners, making it possible to reorganize the entomological service under the direction of the senior entomologist in charge of special regulatory work in entomology.

COOPERATION

Certainly the progress of work in this bureau must embody the full and adequate cooperation with outside agencies and departmental functions similarly engaged.

Within the bureau our nursery service depends, to a large extent, upon the entomological and plant pathological services for determinations of pests and diseases found in nurseries and aids in the matter of control suggestions. The plant quarantine service similarly utilizes the entomological and pathological staffs to assist in making surveys, in scouting to determine pest spread and in making host determinations. Our present organization permits the freest cooperation between the separate offices to develop a maximum efficiency.

In conjunction with the Division of Chemistry of the Department, it has been necessary on numerous occasions to receive technical help in the matter of weed killers, rodenticides and spray materials, and in conjunction with these experts to work cooperatively with the University of California, United States Bureau of Entomology, and the United States Food, Drug and Insecticide Administration in matters of joint recommendations for the control of destructive pests and facilitate the movement of commodities without objectionable spray residue.

Collaborative arrangements have been continued with the Federal Horticultural Board in caring for the enforcement of foreign federal quarantines at California ports and elsewhere within the state, and in

the enforcement of domestic federal quarantines. As collaborators of the Federal Horticltural Board, the entomological and plant pathological staff of this bureau cares for the inspection of nursery stock at the Plant Introduction Gardens at Chico to check on possible pests and diseases, especially any new ones which by chance may have come in on imported material. Approximately 24,000 pieces of nursery stock were inspected during 1927 at this garden during the digging period.

Cooperation with the United States Bureau of Entomology brings to the Department and federal bureau a mutual benefit in the matter of insect control investigations and pest spread determinations.

The United States Bureau of Biological Survey continues in a cooperative capacity for both rodent and predatory animal control work. In the latter case only one leader of predatory animal control appears necessary and this has been arranged in the person of the federal representative, with matters of policy being decided jointly between the two agencies as it affects work both on a statewide and local basis.

In anticipation of white pine blister rust spread into California, the office of Blister Rust Control has remained an active leader in a cooperative project to which the College of Agriclture and the State Board of Forestry are also parties.

During the year close contacts have been made, especially on account of weed, insect, and animal pest control, with other cooperating agencies such as the California Citrus League, the California Highway Commission, the California Development Association, Agricultural Legislative Committee, California Wool Growers' Association, California Nurserymen's Association, farm bureaus, local pest control committees, railroads, fig industry representatives, etc., all of which agencies are concerned either directly or indirectly with the advance of agricltural pest prevention and control in California. The most valued assistance and co-working of the county horticultural commissioners has been of exceptional note during the year.

PLANT QUARANTINE SERVICE*

To the plant quarantine inspection service is delegated the enforcement of those state laws and regulations having for their object the protection of California plant life from the introduction of injurious insect pests, injurious animals and plant diseases. Briefly these laws and regulations are as follows:

The State Quarantine Law, a basic inspection act, which requires that all plant material brought into this state must be inspected, and as a condition of entry must be free of serious pests.

Section 2319b of the Political Code authorizes the Director of Agriculture, with the approval of the Governor, to place quarantines at the boundaries of this state or elsewhere within the state to protect agriculture from the introduction or general dissemination of injurious insect pests or plant diseases. Under authority granted in this section, twelve quarantine orders are now being enforced. Ten of these are established at the boundaries of the state and directed against insect pests and plant diseases which do not occur or are not generally distributed in California and which are seriously injurious to the crops

*By A. C. Fleury, Supervising Quarantine Officer, Sacramento.

they attack, and two orders directed against insect pests of a serious nature, confined in their distribution within the state to those certain limited areas which have been placed under quarantine.

Quarantine circulares issued by the Director of Agriculture to permit of uniform and adequate enforcement of certain provisions of the State Quarantine Law applicable against certain pests. Seven such quarantine circulars are now in effect.

The Date Palm Law, an act of the legislature regulating the movement within the state of date palms to prevent distribution of serious date palm scale insects.

Shipment of Injurious Insects Law, an act of the legislature to prevent the importation into this state or the transportation within the state of injurious insects, except for specific scientific purposes under permit and proper safeguards.

In addition, the enforcement of two restrictive measures known as Pest Control Rulings Nos. 3 and 4, covering strawberry root weevils and vegetables, pests occurring in limited portions of California.

Further, state inspectors at maritime ports of entry enforce the forty or more federal plant quarantine regulations issued by the United States Secretary of Agriculture under authority of the Federal Plant Quarantine Act. These inspectors, as collaborators of the Federal Horticultural Board, are the sole enforcing agents of federal plant quarantines at California ports of entry.

MARITIME PORT INSPECTION

California has eight harbors where vessels can enter to discharge or take on cargo. The three ports of San Francisco, San Pedro and San Diego are of chief consequence so far as amount of plant quarantine enforcement is concerned. At the five remaining ports careful supervision is given all vessels arriving from other states or foreign countries by the local county horticultural commissioner who acts as State Quarantine Guardian and collaborator of the Federal Horticultural Board.

At San Francisco fifteen quarantine inspectors are stationed, one being assigned to Crockett and one to Oakland. Seven inspectors are located at San Pedro (Los Angeles Harbor) and two at San Diego.

There has been no radical change in port inspection methods during the past year. The following chart (see chart No. 1) will show that shipping and imports requiring plant quarantine inspection have consistently increased over the previous year.

Fortunately, it has been possible to meet these increased inspection requirements of the past year without increasing the personnel. The demands are not regular from day to day as there may be many ship arrivals on one day or on several days in succession, with but few on another. In the latter case only a portion of the inspection force is needed. In that regard, our inspection organization at maritime ports is comparable to a city's fire fighting organization; sufficient personnel must be maintained for the district to adequately take care of the demands of the busiest day, with assistance available at more distant stations for abnormal demands.

Inspection of vessels at maritime ports will probably always remain the most important feature of plant quarantine enforcement, as the

more serious pests to be guarded against are those occurring in outlying territory and in foreign countries, particularly Hawaii, the Orient, Mexico, and the Tropics. Owing to the presence of Mediterranean fruit fly and melon fly in Hawaii and its proximity to California, the inspection of vessels from that territory is of major importance. In addition to the many passenger vessels from the Orient and the Antipodes which call at Hawaiian ports on their return voyage, there are eight regular passenger liners operating on direct runs between Hawaii and California ports. Two of these vessels have been added during the past year—the S. S. *Malolo*, sailing every two weeks from San Francisco and having a capacity of about 700 passengers, and the S. S. *City of Honolulu*, sailing out of San Pedro monthly with a passenger capacity of about 500.

To properly and efficiently inspect within a reasonable time the baggage of passengers on vessels of this size requires the services of from thirty-five to forty inspectors. To meet this condition at ports where normally but seven to fifteen inspectors are employed it is necessary to draft the services of county horticultural inspectors and of employees of this department in the near vicinity who are engaged in other than plant quarantine activities. These men soon become trained and capable of satisfactorily augmenting the regular force for prompt and careful examination of baggage on these occasions.

Particular attention has been directed at the ports to the examination of all parcel post mail and express matter arriving from Hawaii regardless of whether the marking indicated the contents to be plant products. The justification for such inspection is demonstrated by the repeated interception of contraband fruits in such express and mail parcels, which, because of lack of marking as to contents, would undoubtedly otherwise have been delivered. Avocados in an express parcel marked "books;" mangoes, coffee berries and other host fruits of Mediterranean fruit fly in other unmarked parcels have been so intercepted during the year. Inspection of parcel post material from Hawaii frequently requires the services of 10 or more inspectors from four to five hours after mail has been unloaded. It is not uncommon for upward of 6500 parcel post packages to be discharged from one vessel, in addition to many packages of express matter, the most of which must be opened to determine their contents.

Though a careful search of all vessels is made upon arrival it is readily possible for crew members to secrete contraband fruit in a portion of the ship where it would not be disclosed by such inspection. That any baggage or parcels brought ashore by anyone at any time after a vessel has arrived may be carefully examined for the presence of contraband, particular attention has been given during the past year to properly guarding vessels of Hawaiian or foreign origin while in port.

While quarantine regulations are specific, much in their method of application must be left to the judgment of the inspector. Particularly is this the case with prohibited plant material carried as ship stores and not intended to go ashore. The degree of menace involved is largely the factor which influences the inspector's judgment in determining what safeguard measures shall be required. It is essential that all

vessels be required to give the same disposition to fruits or vegetables carried as stores or otherwise at each California port. Disrespect of plant quarantine laws and possible deliberate attempts at evasion will follow on the part of the ship's officials when uniformity in the application of the quarantine regulations is lacking. The value of securing the cooperation of the steamship company officials has long been recognized and such cooperation can be secured only when they are aroused to the importance of keeping out serious agricultural pests, and their interest can be maintained only when sound, business-like and uniform methods of enforcement are followed.

To prevent landing of prohibited plant products carried as stores or by the personnel of naval vessels is just as important as though such contraband material were carried by commercial craft. The Army Transport Service officials at San Francisco and the naval officials at all ports, particularly the Commandant of the Eleventh Naval District at San Diego, at which port most naval craft arrives, have given most commendable cooperation in the enforcement of the plant quarantine regulations on vessels operated under their jurisdiction, and what would otherwise prove a tremendous task and a serious menace is efficiently accomplished with full safety through the willing and friendly assistance of these officials.

Over 2600 insect pests and plant diseases have been intercepted at California ports during the year. Many of these do not occur in California and their introduction would undoubtedly occasion serious damage to our agriculture. Among those intercepted during 1927 were a number of special interest. From Hawaii the melon fly was taken six times in cucumbers and once in tomatoes; the Mediterranean fruit fly was taken three times each in mangoes and avocados, twice in guavas, once in string beans, once in coffee berries and and once in Kamani nuts. One interesting fact in connection with the interception of the Mediterranean fruit fly in Kamani nuts was the finding of adult flies in the box in which these nuts were brought in by a passenger. These flies had evidently emerged enroute and only the closed nature of the box in which the infested nuts were placed kept them from escaping. This represents the first interception of adult Mediterranean fruit flies made in quarantine at a California port. Pink bollworm was taken in cotton bolls on six occasions. Sweet potato weevil was taken in sweet potatoes from China and Alabama. *Myelois venipars*, a navel orange worm of Arizona, was taken in Tamarinds from Mexico and the interception of *Stenoma catenifer* in avocado seed from the Canal Zone was considered important by the Federal Horticultural Board. Chestnut weevils were taken fifteen times from four countries, and lepidopterous larva, undoubtedly the nut codling moth (*Carpocapsa splendana*), was taken on several inspections from chestnuts from Italy and once from chestnuts from Japan. *Prays citri*, a moth which mines the skin of citrus fruits was taken in an orange from Guam. The camphor scale, *Pseudaonidia duplex*, was taken on oranges from China. Citrus canker was taken on pomelos from China and citrus melanose was intercepted on numerous occasions on citrus fruits from Porto Rico, Panama, the Canal Zone, Mexico, Florida, Texas and Louisiana. The Dictyospermum scale, *Chrysomphalus dictyospermi*, was taken on

thirteen occasions from the Canal Zone, China, Hawaii, Italy, Mexico, and Tahiti on citrus fruits, cocoanuts and bananas. Dead adult Japanese beetles were found on numerous occasions on freight and in the holds of ships arriving from Philadelphia. The cherry fruit fly was taken several times in cherry shipments from Oregon.

BORDER INSPECTION

Under this designation is grouped those activities of the plant quarantine service which are concerned with the inspection of automobiles and other vehicular traffic entering this state.

During 1927, fourteen inspection stations were maintained along our eastern border covering all highways leading into this state from the eastern and southern United States. Eleven of these stations, located from Inyo County north to the Oregon line, were seasonal, being operated during the summer when the roads were not closed by snow. While the inspection of automobiles entering this state is for the purpose of enforcing all quarantine regulations, these northern seasonal stations are concerned principally with the quarantine against alfalfa weevil as they control the movement of traffic over highways leading into California directly from alfalfa weevil infested sections of Nevada. The three southern stations are operated the year around and are concerned principally with the quarantines against cotton pests and the citrus diseases as they control traffic entering over highways leading from the southern states where these pests occur. The following chart shows the border inspection record for 1927 as compared with 1926:

Border Inspection

	Automobiles inspected	
	1926	*1927*
Seasonal	59,960	73,303
Year around	99,025	125,380
Totals	158,985	198,683

Nineteen twenty-seven shows an increase of 39,698 automobiles or nearly 25 per cent over 1926. A slightly larger force of inspectors was necessary to handle this increased traffic.

During 1927 there were taken from camping equipment carried in 296 different automobiles, all destined for interior California, 2111 live alfalfa weevil, all intercepted at northern border stations. Although traffic increases each year, with the improvement of camping grounds located in the infested sections of adjoining states and the construction of cabins, eliminating the necessity for campers erecting tents and spreading bedding on the ground, less alfalfa weevil are carried and fewer interceptions made from year to year.

However, the quantity of contraband plant material seized increases each season as traffic increases. There were intercepted and destroyed at all border stations during 1927, 6714 lots of contraband plant material being brought into California in violation of the state quarantine regulations. In addition, 1951 lots of plant material were refused admittance because of actual infestation with some insect pest or plant

disease or because of noncompliance with quarantine requirements. This intercepted plant material represented quarantine violations as follows:

Citrus canker	3,500
Cotton boll weevil and pink bollworm	2,263
Oriental fruit moth	798
Sweet potato weevil	667
Navel orange worm	669
Alfalfa weevil	114

In addition, there were intercepted 594 lots of miscellaneous material comprising violations of the white pine blister rust, citrus white fly, Mexican fruit fly, Japanese beetle and other quarantines. Live cotton boll weevil were taken on numerous occasions during the year at each of the southern border stations. These were present in souvenir cotton bolls, cotton seed and seed cotton found in suitcases, hat boxes, hand bags, etc., carried by automobile travelers. Home made mattresses and pillows stuffed with seed cotton were frequently intercepted. The large quantity of menacing material intercepted during the year 1927 demonstrates the important part border inspection plays in an adequate system of quarantine inspection.

Changes in methods and improvements in equipment have been made at the southern border stations. These have facilitated inspection and have done much to prevent complaints from travelers. Additional platforms have been constructed, shed roofing has been placed over such platforms, protecting both travelers and inspectors from the hot sun in the summer and the rain in the winter, and benches have been built on which hand luggage is placed for examination.

INTERIOR INSPECTION

Practically all nursery stock shipped into California from other states and most of the fruit, vegetables and other commodities subject to plant quarantine inspection arrives by railroad, freight, express or parcel post, and the task of examining and passing upon the admissibility of this large volume of material at railroad stations, express offices and post offices is classed as interior inspection. This inspection is carried out by the county horticultural commissioners, their deputies and inspectors acting as state quarantine guardians.

During the fiscal year ending June 30, 1927, these state quarantine guardians inspected and passed upon 52,620 shipments of plants and products from other states. One thousand three hundred ninety-eight shipments were refused admittance because of insects or disease pests, or condemned as contraband, having been shipped into this state in violation of the quarantine provisions. The total of 52,620 shipments inspected during the present fiscal year shows a slight decrease over the previous year.

ALFALFA WEEVIL

The usual annual alfalfa weevil field survey was made during the spring of 1927 to determine the spread of the alfalfa weevil in California and showed very little change from 1926. As expected, that insect was found to have spread in the Honey Lake Valley in southern

Lassen County to a point one-half mile southeast of Milford, about three and one-half miles further north than it could be found in 1926. The infestation in that valley was very light as was also the case with the infestation in Long Valley and in the Sierra Valley of Plumas County where no appreciable spread was noted and where the weevil was less numerous than in 1926.

All of the California infestation is still well within the quarantine boundary lines originally placed against this insect, and its spread to date in this state has been by natural flight along continuous alfalfa plantings.

The usual survey in that part of Nevada adjoining California was carried on in cooperation with the Nevada officials and for the first time the weevil was discovered in Douglas County. Infestation there could be found only in a small portion of but one field. The Nevada authorities immediately destroyed the crop of this entire field by plowing and burning, and clean cultivation was then practiced with the expectation and hope of eradication. Douglas County, Nevada, was immediately added to the area under quarantine by this state on account of the alfalfa weevil. This infestation is unfortunate, as the alfalfa plantings in Douglas County adjoin those in Mono and Alpine counties, California, and if the eradication attempt is not successful, this new Nevada infestation will unquestionably spread to fields in adjoining California counties, where, although still east of the Sierra Nevada range, the hazard of its being carried into our great interior valleys will be increased. In placing the quarantine against Douglas County, the fact that for certain mountain and desert communities in Alpine, El Dorado, and Inyo counties, California, near the Nevada line, Douglas County was the only source of hay for fodder, resulted in a provision for such hay to move into those boundary communities under permit when the Director of Agriculture was satisfied that such movement would present no alfalfa weevil menace to California.

THURBERIAE WEEVIL AND PINK BOLLWORM IN ARIZONA

Late in 1926, following the finding of the pink bollworm and Thurberiae weevil in southeastern Arizona, California placed into effect stringent quarantine measures against that entire state until such time as a careful and complete survey could be made to positively determine the exact distribution of those serious cotton pests in Arizona. These quarantine measures remained in effect and no cotton seed was admitted from any point in the state of Arizona until August 1, 1927. On that date the Federal Horticultural Board issued revised quarantines outlining the areas where these pests occurred and provided certain safeguard measures for the movement of possible carriers of those pests from Arizona, following which cottonseed was again admitted from those sections of Arizona not included within the federal quarantine area.

COTTONSEED CONTAMINATED GRAIN

During 1927, it was noted that shipments of corn, maize, oats, and other grains were arriving from the southern states contaminated with cottonseed. As this presented a distinct menace to the cotton industry

of this state, due to the possibility of cotton boll weevil or pink bollworm being introduced through the medium of such seed, orders were issued to all inspectors to place in quarantine any such cottonseed contaminated grain shipments, and to require that all such cottonseed be entirely removed from the grain by screening or other methods or that the entire shipment be reshipped out of the state. Meetings with grain importers were held and their cooperation in eliminating this condition was secured. Many cars of cottonseed contaminated grain were intercepted and were cleaned at considerable expense. Through the cooperation of grain importers and shippers, the conditions that brought about this contamination largely have been corrected and only an occasional carload is now found.

QUARANTINE ORDERS REISSUED

Following the Supreme Court decision nullifying the right of the states to place plant quarantine regulations and the correction of this condition through the amendment to the Plant Quarantine Act of April 13, 1926, it became necessary to reissue all of our quarantine orders in the early part of 1927. This permitted of certain revisions in the regulations which past enforcement experience had shown were desirable, such as the incorporation of all amendments in the original quarantine, the elimination of some unnecessary restrictions, and the bringing up to date of the orders. Also, in a general way, it brought all the quarantine restrictive measures of this state into a more compact form where they would be readily available and better understood. These revised quarantine orders, twelve in number, were put out under the designation of "New Series," and pertained to the following: Citrus Canker, Chestnut Bark Disease, Oriental Fruit Moth, Eastern Filbert Blight, Mexican Cotton Boll Weevil, and varieties thereof, and Pink Bollworm of Cotton, Citrus Melanose, Alfalfa Weevil in other states, Alfalfa Weevil in California, Sweet Potato Weevil, Citrus White Fly in other states, Citrus White Fly in California, and Nut Tree Insects.

During the year it was found necessary to amend the alfalfa weevil quarantine on two occasions, first to add Douglas County, Nevada, to the infested area, and second, to eliminate the Smith Valley in Lyon County, Nevada, from the provisions of quarantine until March 1, 1928. The Douglas County, Nevada, quarantine amendment was revised on December 23, 1927, in a minor particular.

The quarantine order pertaining to citrus white fly in California also was revised on December 23, 1927, to add the cities of Gridley and Oroville in Butte County and an additional area in Sutter County in the vicinity of Yuba City to the quarantined area, owing to the finding of citrus white fly since the original quarantine was issued. Several additional hosts on which the white fly had recently been found were also added.

All formerly so-called quarantine regulations and rulings were also reissued under the designation of Quarantine Circulars (New Series) and were seven in number, pertaining to Peach Yellows and Peach Rosette, Cherry Fruit Fly in Oregon, Cherry Fruit Fly in Washington, Strawberry Root Weevils in Oregon and Washington, Colorado Potato Beetle, and Grape Phylloxera, and the Navel Orange Worm.

CHART No. 1—MARITIME INSPECTION—CALIFORNIA PORTS

	San Francisco		San Pedro		San Diego	
	1926	1927	1926	1927	1926	1927
Steamship and baggage inspection:						
Vessels inspected	3,035	3,290	3,198	3,997	620	799
Fish boats			360	498	878	999
Passengers	48,298	48,726	15,839	17,204	1,395	2,021
Horticultural imports:						
Parcels fumigated or otherwise treated	90,495	69,100	8,015	9,697	50	69
Shipments refused admittance	1,842	1,426	163	327	108	48
Contraband shipments	1,123	1,414	488	1,289	254	322
Total parcels, horticultural imports	3,862,784	4,257,648	1,056,808	1,485,262	346,617	410,521
Total shipments, horticultural imports	37,381	35,225	4,815	5,878	6,687	5,879

At the five minor ports of entry in California there were inspected in 1927, 62 vessels carrying 44 shipments of plant material, comprising 10,652 parcels. One of these shipments was refused admittance as being contraband.

SPECIAL REGULATORY PEST CONTROL*

The major problem of the year has been the administration of the citrus white fly project, and next in order of importance is an investigation of the Mexican fruit fly in the lower Rio Grande Valley of Texas. Special reports on these two activities will be found in other numbers of the MONTHLY BULLETIN.

Since the major portion of the time has been taken up by these two projects, other work, including vacuum fumigation, testing of certain spray oils and miscellaneous pest projects has been relegated to a minor position.

CITRUS WHITE FLY

The administration of the white fly project was beset with obstacles arising mainly from the fact that no previous campaigns had been carried on along these lines and much of the data necessary had to be worked out during the campaign. We had only fair knowledge as to areas actually infested and further, there was only general knowledge of insecticides which would lend themselves to this particular problem. Such circumstances necessitated the application of new and untried methods and also the designing of special equipment to meet the different needs. The fact that the campaign undertaken had to be finished before the spring emergence of the adult fly greatly complicated the situation. A better idea of these difficulties can be gained if we understand that the basis of the campaign was predicated on only 325 infested blocks in Sacramento, four blocks in Yuba City and the entire city of Marysville. As a matter of fact, we found the pest distributed over nine hundred blocks in Sacramento, so located that any campaign looking to suppression involved treating the entire city. In the Yuba City area, inspection revealed the infestation general throughout the city, also extending five miles west and ten miles south of that city.

Further surveys revealed the city of Gridley infested and also Oroville, in addition to small infestations at points as far as eight miles north of Marysville and one thirteen miles south of Sacramento, a second thirteen miles east of Sacramento, also in North Sacramento and

*By D. B. Mackie, Senior Entomologist, Sacramento.

in Broderick, Yolo County. To locate and plot these infestations has required extensive and detailed inspection of all citrus and privet in Sacramento County with the exception of certain commercial plantings in the Fairoaks district which could not be completed due to lack of time. All citrus in Yuba and Sutter counties and large portions in Butte County have been inspected.

Similarly with host plants, where only eleven were originally listed at the beginning of the spray program, the host index had been increased to forty, and by March 1, 1927, it was raised to fifty-four. Such a condition required the development of a potential host index, necessitating the spraying of non-host species. Since the development of a complete index it has been possible to cut a number of species from the list, thus effecting extensive saving in material and labor.

At the beginning of operations the only conclusion that could be drawn with reference to insecticides was that sprays offered the chief chance for success, with oil emulsions least injurious to house paint. It has been possible to develop formulas suitable to the needs of the campaign utilizing a number of the commercial oil sprays. Where material at first cost about $1 per gallon, the present winter's supply has been secured at a cost of 32 cents a gallon. During the year, approximately eight carloads of emulsifiable oil have been used.

Six sprayers of the largest capacity obtainable were purchased, two of which are motor mounted and four on trailers. Two supply trucks were also bought.

To protect house paint from possible damage by oil sprays, special gear has been designed, such as extension poles, tackles, waterproof canvas, etc. This latter equipment is necessary because of large percentages of citrus and other hosts being close to houses.

A study of spray machinery and accessories constituting general sprayer equipment has shown a lack of coordination between manufacturers of sprayers and of accessories. Minor improvements in hose and couplings were shown to greatly increase the efficiency and at the same time effect large reductions in weight. Our most outstanding improvement has been the development of a new type of spray gun to combine in one implement the spray pole and the gun. This alone increases the spraying ability of one nozzleman fifteen hundred gallons per week of forty-eight hours.

Due to increased areas, some temporary injury was caused to plant life which was sprayed late during the period of actual growth. This resulted in blossom drop in citrus and some injury to foliage of other hosts. This temporary injury was more than balanced by control of other plant pests on the trees.

The summer campaign was confined to the heavier infestations in Marysville, Yuba City, and Sacramento. The 1927–1928 winter's campaign started December 1st. On December 31st practically forty-five per cent of the areas to be sprayed had been completed.

The results have exceeded anticipations. It has been demonstrated that consistently higher percentages of kill can be obtained by close attention to the application of contact insecticides than is secured in

general orchard practice. Ninety-eight per cent effectiveness has been set as the minimum result to be obtained and where not secured, trees were resprayed.

MEXICAN FRUIT FLY

Approximately two months were spent investigating the Mexican fruit fly situation in the lower Rio Grande Valley of Texas. During the period in question, a complete study was made of the programs of the United States Department of Agriculture and the state of Texas looking to the eradication of this fly. Surveys were made to ascertain the possible hazards that might exist from (1) the native growth, (2) plants in residential property, (3) host plants in the lower Rio Grande Valley of Mexico, (4) fruit arriving in markets of the Mexican cities of Matamoros and Reynosa from distant points in Mexico known to be infested with the fly, and (5) climatological factors.

These surveys were carried out in great detail, listing all potential hosts, their technical and local name, together with a commentary as to their specific relationship to the fruit fly situation. In a special report all these data have been brought together. It includes wild native growth, cultivated plants, and species of Mexican fruit that move over the railways. We also worked out the synonymy of certain host fruits whose proper designation was somewhat confused by local names. An attempt has been made to furnish data that will give a better estimate of the hazard to the citrus and other fruit industries should species be introduced into the territorial United States.

MANDATORY TREATMENTS

In the field of mandatory treatment applied by reason of regulations of other states, vacuum fumigation has permitted the movement of early California potatoes as follows:

	Tons
Oregon	919.68
Washington	206.03
Idaho	54.29
Iowa	43.80
Colorado	16.50
Utah	264.18
California	109.37
Total	1612.85

Exclusive of California, this represents about fifty carloads long haul freight of a commodity which would not otherwise move because of insect infestation subject to interstate regulation.

This same treatment applied to citrus nursery stock alone has permitted the movement into Arizona of 24,000 citrus for planting on the Yuma mesa. Into the county of Ventura, 72,679 incoming trees were treated while 14,196 coming into Orange County were treated.

In addition to the foregoing, dried fruits, nuts and other food commodities involving several thousand tons have received this treatment by reason of a lowered tolerance from 20 to 10 per cent on products carrying insect infestation.

MISCELLANEOUS

During the year a number of different oil emulsions have been tested out in connection with certain fruit tree pests. These include black scale on olive, yellow scale on citrus, European elm scale on elms and brown apricot scale on apricots.

There have been inquiries on pest control methods from out of state parties, most of these seeking information on improved fumigation methods. These have come from France, Spain, Germany, Italy, Turkey, and Russia.

FIELD ENTOMOLOGY*

INVESTIGATIONS OF NEWLY ESTABLISHED INSECTS

Investigations have been made of newly established insects of major importance to determine facts necessary to regulation, restriction and control. Examples of such insects that have received attention include the vegetable weevil, strawberry root weevils, and the European earwig.

VEGETABLE WEEVIL

The investigation of the vegetable weevil, *Listroderes obliquus* Gyll., has received more attention than any other one project in field entomology during the year. Inasmuch as previously very little was known of this insect, its seasonal history, habits and control, and nothing at all under California conditions, it was necessary to make detailed investigation before regulatory as well as control measures could be developed. This insect has been known to occur in the state less than two years; hence, any statement at this time as to its importance may be premature; nevertheless, it appears to be a major pest of certain truck crops.

In isolated areas given to intensive truck crop production, where a variety of vegetables are growing throughout the entire year, extremely favorable conditions for producing heavy infestations have been afforded, resulting in the total loss of some small fields of certain preferred host vegetables. The increased territory showing infestation during the past year indicates that the weevil has occurred probably in the state for a number of years, also that while the insect has only recently become noticeable, it is increasing.

The investigation has concerned itself with the determination of its seasonal history which might affect regulatory action as well as control, and noting trade practices which relate to the possible distribution and further spread of the weevil, also listing of host plant carriers. Surveys to define the limits of distribution have been carried on with the finding of this weevil in the following counties: San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Solano, and Marin. Scouting has been extended over a good portion of the state and will be continued.

All control investigations have been directed toward finding a suitable emergency control measure to protect growers and to aid in checking

*Joint Report by T. D. Urbahns, Field Entomologist, resigned November, 1927, and H. C. Lewis, Assistant Entomologist, Sacramento.

further spread. Studies of seasonal history have shown the larval stages, which cause the most severe damage, active during the fall, winter, and spring when weather conditions are very changeable. The adult spends the summer months in aestivation. The fact that numerous vegetables, the tops of which are used for human consumption, can not be sprayed with an arsenical, that egg deposition continues from fall until spring and that any spraying for larval stages must be done under adverse weather conditions, have made for a difficult problem of larval control. Contact insecticides for larvae have been used during the past season for the first time with partially satisfactory results. On account of high cost, this control would hardly be practical on a commercial basis, although for small garden patches it is satisfactory. A combination of a 2 per cent light grade of summer oil emulsion and nicotine sulphate, one to sixteen hundred, was effectively used last November. Pyrethrum at the rate of three to five pounds per hundred gallons has also proved effective.

The most promising control appears to be in checking newly emerged adults in the late spring. Considerable testing has been made of various baits which might prove attractive to adult weevils. A fruit bait found in May gave approximately 90 per cent kill in forty-eight hours in cages containing natural food. It has been observed that certain preferred host plants of the adult may be utilized as trap crops. Cooperative observations of seasonal history and control measure tests have been made by L. R. Cody, Horticultural Commissioner of Santa Clara County.

Detailed information from investigations on the vegetable weevil was published in the MONTHLY BULLETIN for July, 1927. A second article will appear shortly setting forth later information developed.

STRAWBERRY ROOT WEEVILS

The Nursery Service indicated that one or more of three species of weevils occurred in strawberry plantings in Humboldt County. A survey covered Humboldt and Del Norte counties last August to determine the presence of weevil, distribution trade practices and all facts necessary to suppression and regulation. In Humboldt County, *Brachyrhynus sulcatus* (Fabr.) and *B. rugostriatus* Goeze were found quite generally distributed in strawberry, blackberry, raspberry and loganberry plantings. In Del Norte County, *B. rugostriatus* and *B. ovatus* (Linn.) were found. Considerable damage had taken place in a few fields, although generally berry culture had not been materially hampered by the presence of these weevils. Native wild species were examined but no indication of infestation noted.

During early 1927, curculionid larvae were reported in large numbers in a commercial strawberry planting near Watsonville. As the possibility existed of one of the three species of *Brachyrhynus* commonly attacking strawberries in the Northwest, preparations were made in cooperation with the horticultural commissioner of Santa Cruz County to prevent spread and to eradicate the infestation. The emergence of adults in May, however, proved the species to be Fuller's rose beetle, *Pantamoris godmani* (Crotch). These larvae fed extensively on the roots, and in certain parts of the strawberry field many

plants were killed. Calcium cyanide introduced into a hole made with a small crowbar about six or eight inches deep near each plant resulted in a kill of both larvae and plants. As only plants showing a weakened condition due to injury were treated, their loss was of no consideration. The cyanide treatment considerably reduced the larval infestation.

EUROPEAN EARWIG

Attention was given to testing baits, making field observations on life history, habits and spread of the European earwig, *Auricularia forficula* (Linn.), in Berkeley. The earwig is now known to occur in a number of distinct and separate infestations in the cities of Berkeley, Oakland, and Albany. Poisoned baits as used in the Pacific Northwest have not furnished the efficient control hoped for. Animal oils, vegetable oils and essential oils have been tried as attractants but nothing has been found definitely and outstandingly attractive to the earwigs. This work was in cooperation with Mr. H. A. Tibbits, Park Superintendent of Berkeley.

FIELD SERVICE

Assistance was given county horticultural commissioners and agricultural agencies, and meetings attended for the purpose of discussing the most recent and effective methods of controlling insects destructive to field and orchard crops. Meetings were held in regard to spray residue, blister mite, cankerworms, rust mite, codling moth, peach twig borer, and methods of increasing the efficiency of insect control in general. A laboratory service is maintained to aid in determinations of economic insects.

An unusually heavy infestation of cankerworms, *Alsophila pometaria* (Harris), and *Paleacrita vernata* (Peck), developed on deciduous fruit in the Sacramento, Santa Rosa, and Santa Clara valleys in April and May. Very effective control was obtained by the use of two and one-half pounds of ground pyrethrum to one hundred gallons of spray. This was used extensively by growers, being an outstanding example of an industry immediately accepting a newly proved control.

Larvae of the lesser corn stalk borer, *Elasmopalpus lignosellus* (Zeller), were referred to this office in August from Blythe, Palo Verde Valley, Riverside County. Determination of the species was made and method of control recommended by this office. Several corn fields were entirely destroyed near Blythe, according to the local horticultural inspector. As the infestation develops rapidly once it is established in a field of young corn, control is difficult. Clean cultivation, destruction of all weeds and corn stalks to reduce the infestation of moths as well as plant corn on land previously kept clean were measures recommended.

Inquiries have been received by the department as to the best means of controlling borers in cypress. The twig borer, *Phlocosinus cristatus* (Lec.), which is the common interior species, was found causing severe damage to Monterey cypress in parks in Fresno County during October. The summer brood of beetles were attacking and girdling the trunks and larger branches resulting in the death of the trees. Arizona

cypress were being attacked, the beetles pruning the smaller twigs for the purpose of feeding. Control information furnished by Dr. E. C. Van Dyke of the University of California follows:

As Monterey cypress is not suited to drought conditions in the interior, it frequently becomes weakened and may be severely attacked by beetles. Heavy infestations are thus established which may attack normal, healthy Arizona and Italian cypress by pruning the smaller twigs. The problem is one of sanitation and proper selection of types of trees. The heavily infested trees and branches should be cut out and burned in the late fall or winter, thus eliminating the breeding of the main broods. Cypress trees should never be planted near such water-exhausting trees as eucalyptus, and Monterey cypress should not be planted very far from the Coast.

The peach twig borer, *Anarsia lineatella* (Zeller), did not cause the damage in 1927 characteristic of recent years. Control measures were applied with unusual care and persistence throughout the state, due to a combined campaign by the State Department, University of California, county agencies and farm journals encouraging better spraying. The general use of efficient control methods and natural enemies is probably responsible for the temporary light damage to peaches. This borer is becoming of increased importance on prunes in Sutter and Colusa counties, where some damage has been done. One orchard of French and Imperial varieties in Colusa County was found to average about thirty infested prunes per tree in parts of the orchard. Injury is caused by larvae at the junction of the stem and fruit, causing the fruit to fall to the ground just before ripening. The peak of this injury was noted during the latter part of July and August.

Joint recommendations for the control of the peach twig borer were drawn up and distributed to growers by this office and the Division of Entomology of the University of California.

The codling moth, *Carpocapsa pomonella* (Linn.), was held reasonably under control during the year. Extensive and thorough early spraying was encouraged to eliminate the first generation of worms as well as to avoid objectionable spray residues caused by heavy late spraying. Tree banding was strongly recommended and while it is not in general practice over the state, very good results have been obtained in orchards previously heavily infested.

In the Lake County pear district larvae were somewhat difficult to find, whereas, a year ago they were plentiful. In the packing sheds, in 1926, moths could be found in numbers on the screen windows, while this year the infestation was very light.

In the Santa Clara Valley fog belt some pear growers have obtained beneficial results by increasing the amount of basic lead arsenate used.

Joint recommendations for codling moth control were prepared and placed in the hands of growers by this office and the Division of Entomology of the University of California.

In August it was reported that the walnut codling moth, *Carpocapsa pomonella* (Linn.), had been found in Lake County. Two examinations of the nuts on the trees, on the ground, the drying trays and in storage showed no evidence of infestation, so it is believed that storage insects were mistaken for codling moth.

While red spider, *Tetranychus telarius* (Linn.), is normally considered a serious pest of deciduous fruits, especially prunes, peaches, and Kadota figs, as well as beans and other field crops, the infestations during the season were unusually light. However, growers of several localities called for recommendations for the control of red spider on prunes, figs, and peaches. The light infestation might, to some extent, be explained by the cool, late spring, other climatic conditions and, possibly, natural enemies.

Aid was requested during the year in grasshopper control as these pests caused more damage than in 1926. Shasta and Lassen counties suffered some damage and the use of control measures in the form of poison baits was necessary. *Melanoplus differentialis* (Thomas) was present in considerable numbers in the alfalfa districts of the San Joaquin Valley.

An infestation of the bean thrips, *Heliothrips fasciatus* (Pergande), developed on pears in the coastal mountain valleys, requiring special control investigations in July and August. Damage occurred in Lake, Mendocino, and Napa counties. Various insecticides were tested, the most satisfactory being a combination of a light miscible oil with nicotine sulphate. Ground pyrethrum and pyrethrum extracts furnished practically as effective control but were not so readily available.

MISCELLANEOUS ACTIVITIES

Testing of new and commercial insecticides has been carried on in cooperation with the Division of Chemistry to determine their effectiveness in insect control as well as safety for use in accordance with the Economic Poison Act. Insecticides receiving particular attention were magnesium arsenate, manganese arsenate, calcium arsenate, commercial poison apple baits, derris extracts, pyrethrum extracts and oils. A special testing ground has been maintained in connection with this work.

Surveys and scouting have been carried on in cooperation with the Plant Quarantine Service to determine the presence and distribution of insects under regulation and quarantine, especially for alfalfa weevil, strawberry root weevil, and the vegetable weevil.

In collaboration with the Insect Pest Survey of the United States Bureau of Entomology, reports of insect damage and outbreaks have been made. The following table has been compiled in collaboration with various authorities in California. It lists in order, based on amount of money spent in control and reduction of yield on account of injury, the ten most important insects or groups of insects and the crops most severely attacked.

Most Important Insects Causing Economic Loss for 1927

Insect or group of insects.	*Crops injured.*
1. Scale insects on citrus:	
Saissetia oleae, Chrysomphalus aurantii, C. citrinus, Lepidosaphes beckii, Coccus pseudomagnolarium, Pseudococcus gahani, P. citri	Citrus
Saissetia oleae	Olives

2. Orchard mites:
   - Tetranychus sp. — Plums, prunes, truck crops, beans, etc.
   - Paratetranychus — Deciduous fruits, citrus
   - Bryobia — Almonds
3. Codling moth:
   - Carpocapsa pomonella — Apples, pears, walnuts in southern California
4. Peach twig borer:
   - Anarsia lineatella — Peaches, plums, prunes
5. Noctuidae:
   - Army worms, cutworms, and corn earworms — Field crops, truck crops
6. Deciduous fruit scales:
   - Diaspis pericola, Aspidiotus perniciosus, and Lecanium sp. — Deciduous fruit
7. Wireworms:
   - Elateridae — Grain, beans, potatoes, truck crops, etc.
8. Grasshoppers:
   - Locustidae — Alfalfa, fruit and nut trees, truck crops, etc.
9. Aphids:
   - Aphididae — Prunes, plums, walnuts, apples, cherries, beans, etc.
10. Thrip:
    - Thysanoptera — Pears, beans, citrus

A very commendable relation has been established with the Division of Entomology of the University of California in preparing joint recommendations for the control of certain major insect pests. This has resulted in uniformity and added weight to the recommendations. Growers can be certain that in such cases they are getting the consensus of opinion as to the most approved methods of control. These recommendations for control of codling moth and peach twig borer were published in the February, 1927, issue of the MONTHLY BULLETIN. Similar recommendations for pests of celery and lettuce growers were prepared in October and are given herewith.

NOTICE TO CELERY GROWERS

The following precautions are suggested by a committee representing the California State Department of Agriculture, the University of California, the United States Bureau of Entomology, the county horticultural commissioners, the California State Department of Public Health, and the United States Food, Drug and Insecticide Administration, in the control of plant diseases and insects to minimize the danger of the crops being condemned on account of spray residue.

A. Celery Blight Control with Bordeaux Mixture.

1. The application of Bordeaux mixture should *not* be made on any celery crop later than four weeks before harvest.
2. any application of Bordeaux should be limited to one hundred gallons per acre.
3. The solution should *not* be stronger than 4–4–50.
4. Greater care must be used in applying Bordeaux to obtain a more general coverage than heretofore and excessive collection of Bordeaux in the crown *must* be avoided.
5. Greater attention must be given to the size of nozzles. The nozzle should have a small aperture not to exceed 5/64 inch.
6. When any Bordeaux residue is visible on the plant, washing should be required.

B. Control of Celery Insects.

1. The use of arsenical insecticides should be avoided in spraying celery, and they should be applied *only* when there is definite evidence of need because of the presence of destructive insects.

2. Poison bran mash bait is recommended for cutworms when they attack celery plants, rather than any form of dust or spray.

3. Application of arsenical insecticides should be made while the celery plants are young; no application should be made after the plants are half grown and in no case should the application be made less than forty-five days before harvest.

4. No application of lead arsenate or calcium arsenate should be in excess of four pounds to the acre per application, either in dust or liquid form.

NOTICE TO LETTUCE GROWERS

The following precautions are suggested by a committee representing the California State Department of Agriculture, the University of California, the United States Bureau of Entomology, the county horticultural commissioners, the California State Department of Public Health, and the United States Food, Drug and Insecticide Administration, to enable the control of insect pests and to minimize the danger of the crop being condemned on account of excess spray residue:

NOTE.—Arsenical insecticides should be avoided except where there is definite need for them.

1. Use poison baits, such as poison bran mash, to destroy cutworms shortly after the lettuce is planted.

2. Use poison baits in place of arsenical sprays wherever possible.

3. Spray or dust with arsenicals only when insect pests are present in sufficient numbers to prove destructive.

4. All spraying and dusting with arsenicals should be done before plants begin to head. Lettuce sprayed or dusted with arsenicals after the head has formed may be condemned by health or regulatory officials.

5. Keep fields as clean as possible from weeds and refuse at all times. Clean culture will keep down the numbers of cutworms and other pests.

PLANT PATHOLOGY*

CONTROL OF POWDERY MILDEW ON CANTALOUPES

In 1926 a very destructive outbreak of powdery mildew (*Erysiphe cichoraccarum*) on cantaloupes in Imperial Valley created a condition which required the application of emergency control measures in the absence of other known and established measures. From observations and data collected in Imperial Valley at that time and from later investigations by this office in the Turlock district, sufficient information was gathered to form a basis for recommendations of control measures in 1927. Those measures consisted of the application of sulphur in dust form by a prescribed method, consisting of two applications of sulphur, either ground or sublimed. It was advised that the first application of sulphur should be made when the paper covers were removed from the young plants, and consisted of placing about one ounce of sulphur in a pile on the ground at a distance of about six inches from the crown of each plant. The second application followed when the first seven or eight leaves unfurled on each runner, and that application consisted in placing about 75 lbs. of sulphur per acre on the ground in rows about one foot from the crown of the plants.

The basis of this recommendation consisted of the following conclusions drawn from the results of investigations in the previous year: (1) young and growing cantaloupe plants are less susceptible to injury by sulphur than fully grown and bearing plants; (2) young plants can develop an increased tolerance for sulphur and retain that tolerance for a long period and under conditions of continuous exposure to sulphur; (3) the amount of sulphur particles in direct contact with

*By D. G. Milbrath, Plant Pathologist, Sacramento.

the surface of foliage and stems should be a minimum amount but with a maximum surface coverage; (4) a cantaloupe plant infected with *Erysiphe cichoraccarum* or injured by aphis in any appreciable amount has shown far less tolerance for sulphur than a normal plant of the same age.

That sulphur in dust form is toxic to the fungus involved has been established in previous experiences with cucumber as host. The point involved in the case of cantaloupe dealt largely with the tolerance of the host for sulphur. Direct contact of sulphur particles with the host was deemed necessary and reliance placed upon constant air currents to carry sulphur from the piles to the plants.

LATE BLIGHT OF TOMATO

Late blight of tomato recurred in 1927 and was more destructive and widespread than in 1926. Early plantings were not attacked, the disease being confined to late plantings to be shipped for table consumption. At least 5,000 acres were severely affected in Ventura, Los Angeles, Orange and San Diego counties.

Leaves, stems and fruit were attacked. In the fruit, infection by the causal fungus was brought about through the sepals and peduncles. After infection of the fruit, manifestations did not become apparent to the naked eye for several days. In some fruit held in storage after picking, discoloration and decay did not appear visible until the seventh day after picking. This long lapse of time before infection could be detected, gave rise to an important pathological problem in transit.

The causal fungus has many characteristics similar to those of *Phytophthora infestans* (Mont.) De By. It is highly probable that further study will lead to its being considered a variation of *P. infestans* (Mont.) De By.

Recommendations for control methods will be issued before the 1928 crop has been planted.

HOT WATER TESTS WITH NEMATODE-INFESTED GLADIOLUS BULBS

In cooperation with the Horticultural Commissioner of San Diego County, tests were made to determine the feasibility of using hot water to eliminate root-knot nematode, *Heterodera Caconema radicicola* (Greef) Muell. from gladiolus corms. Tests were made with a lot of the variety Virginia, employing three temperatures, 110°, 115°, 120° Fahrenheit. The seemingly large number of possible temperature-time combinations are quickly narrowed down. It was found that exposure to 115° F. for two hours killed this variety of gladiolus and that 110° F. for 40 minutes was not sufficient to kill the nematode. Tests at 110° F. for two hours, 110° F. for three hours and 115° F. for 40 minutes appeared to be satisfactory both for nematode control and bulb growth. These preliminary results are intended for a basis in planning more extensive tests covering a wider range of growing conditions and varieties of gladiolus.

POMEGRANATE FRUIT ROT

An investigation of fruit rot of pomegranate was undertaken at the request of shippers in Tulare County. Previous investigations had

found *Alternaria sp.* constantly associated with the rot and occasionally *Sterigmatocystis niger* was found as an inclusion. Further investigation by this office to ascertain whether or not these fungi were secondary to some other primary organism gave no indications of such organism. The nature of any control measure and its application will depend upon the means by which the fungus gains entrance to the fruit. Essig states that *Leptoglossus zonatus* (Dallas) attacks pomegranate fruit and that "it is thought that it spreads heart rot." One of the first attempts to control the disease should be in the form of eliminating by means of poisons whatever insect may be a carrier.

BITTER-PIT OF PEARS

For several years complaints have been received from fruit shippers concerning a malady in the fruit of Anjou pears. This disease was characterized by wartiness of the surface and browning of internal tissues. On investigation it became apparent that the trouble could not be attributed to insect stings but rather to development of a condition akin to bitter-pit. Microscopic examination of the internal tissues indicated crushing of cells by pressure exerted by sap flow. Similarly as in bitter-pit in apples the control of this disease devolves upon regulation of soil moisture.

ROOT-KNOT NEMATODE *(Heterodera radicicola)*

A large number of samples of soil are received periodically for analysis for nematode content. A qualitative analysis of one liter of soil usually requires the entire attention of one man for two working days. One liter of soil is not representative of as small an area as one acre and consequently the cost of examining sufficient samples of soil for a definite determination of one acre or more is prohibitive. This office is engaged in devising apparatus which will simplify soil analysis and reduce cost of examination.

HOT WATER TREATMENT OF NARCISSUS BULBS

Observations were made on the effectiveness of hot water treatment of narcissus bulbs for elimination of *Tylenchus dipsaci*. C. E. Scott examined plants in fields at Santa Cruz and from his observations the general conclusion could be drawn that the standard method of treatment is very effective wherever properly carried out, otherwise slight margins of error might occur. In such cases, quiescent larvae in new infestations might escape destruction.

COTTON SURVEY

From time to time inspections of cotton plants in fields throughout the state were made to ascertain the kinds and distribution of plant diseases. The diseases found were root-rot *(Phymatotrichum omnivorum)*, boll rots *(Aspergillus niger* and *Alternaria* sp.*)*, sore-skin *(*various species of *Fusarium)* and frosty mildew *(Ramularia areola)*. On the strength of these data and on the failure to find certain other diseases, certificates were issued covering certain lots of cotton seed

destined for Peru, setting forth that anthracnose *(Glomerella gossypii)* and angular leaf-spot *(Bacterium malvacearum)* had not been found in the districts of the state in which that seed had been grown.

INSPECTOR'S SCHOOL

During the year, meetings of inspectors of several counties were attended and lectures delivered on plant diseases. The object of the lectures was to explain the symptoms of diseases found in the course of inspection of nursery stock and other plants and to explain the life history of causal organism so as to facilitate inspection.

BORDEAUX MIXTURE ON CELERY

In view of the tolerance established by the United States Food, Drug and Insecticide Administration limiting the amount of Bordeaux mixture in residue form on celery, a conference of interested state and federal agencies was called at Berkeley to formulate suggestions to celery growers enabling them to avoid infringement of the tolerance. At the suggestion of this office, the following spray suggestions were adopted by that conference:

> 4-4-50 Bordeaux mixture, applied at the rate of 100 gallons per acre, no later than 30 days before harvest and with no coarser than a 4/64 inch nozzle.

Recent investigations lead to the conclusion that much of the problem of residue can be solved by the use of proper spray machinery. Up to date, very poor equipment has been in use in celery fields in this state. By the use of a higher powered spray machinery, a fine mist spray can be produced, avoiding residue through the confluence of large drops of Bordeaux. Such machinery should have from 200 to 250 pounds pressure, deliver 8 gallons per minute and be equipped with either a 2/64 inch or 3/64 inch aperture in the nozzles.

DELHI COLONY

At the request of the Director several trips were made to investigate plant diseases in crops on Delhi State Colony lands.

Peach trees were found infested with nematode *(Heterodera radicicola)* and the infestation generally distributed.

In alfalfa fields, a disease known as wilt *(Aplanobacter insidiosum)* L. McC. was found. The organism in alfalfa from fields of the colony was identified by Dr. F. R. Jones, Bureau of Plant Industry, who is one of the first investigators of this disease. Although determined a specific disease caused by a specific organism, there remain several factors unestablished. One of these is the influence of shortage of plant food in the soil. Another is the virility of the organism in cured alfalfa hay. The latter factor must be determined before any danger can be attached to hay moved from infested fields to clean areas.

BUD-ROT OF PALMS

Demands have been made for definite information on the disease known as bud-rot of palms, prompted by the fear lest this spread to *Phoenix dactylifera* in commercial date growing regions of the state.

Our investigations have been in progress to obtain information on the cause and nature of the disease. Recently a new outbreak in *P. canariensis* in Los Angeles afforded good opportunity for further investigations.

DIAGNOSES IN LABORATORY

About 1400 specimens were received and diagnosed in the laboratory. It has become apparent that horticultural commissioners are relying more frequently than heretofore on the diagnoses and findings of this office, particularly when a difference of opinion between interested parties has arisen and court cases might follow. Our diagnoses have been accepted by the disputants and thus legal controversies avoided.

Among the diseases of uncommon occurrence in California the following were found:

Gymnosporangium photiniae (P. Henn.), Kern on *Photinia arbutifolia*. It is the first time that the aecial stage of this rust has been found in America.

Thielavia basicola caused damping off in almond seedlings.

Pseudoperonospora cubensis (Berk. and Curt.) was found on several varieties of melons *(Cucumis melo)* in the month of October in Imperial Valley.

Macrosporium cucumerinum (Ell. and Arth.) was found on melon leaves at the same time the above fungus was observed.

Mosaic occurred on *Lilium formosum* in greenhouse, the bulbs having been imported from the Orient.

Aplanobacter insidiosum (L. McC.) is localized on alfalfa at Delhi.

Heterodera radicicola (Greef) Muell. was found for the first time on pistachio roots.

NURSERY SERVICE*

NEW AND REVISED REGULATIONS

In restricting the spread of pests and diseases in California, the control of the intrastate movement of certain materials likely to carry such pests and diseases is set forth in the act pertaining to county horticultural commissioners. To obtain a more uniform application of these sections of the law the director of agriculture has issued regulations to provide a more definite guide in the procedure to be followed in the inspection of nursery stock or other materials. These regulations have been issued or revised from time to time as the need for them became apparent.

With reference to the disposition of nursery stock infested or liable to be infested with citrophilus mealybug, *P. gahani*, such a regulation was issued March 11, 1927, following a conference between fruit growers, nurserymen, horticultural commissioners and department representatives. This regulation, known as Pest Control Regulation No. 2, serves to limit the rejection of nursery stock presumably infested with citrophilus mealybug to those shipments originating in nurseries actually infested with that mealybug. In addition, it provides a definite method of nursery inspection to determine whether or not a nursery is infested with this pest.

*By Everett L. Smith, Superintendent, Nursery Service, Sacramento.

One very apparent beneficial result has been a greater interest and activity in pest control in nurseries.

The issuance of Pest Control Regulation No. 3 pertaining to the vegetable weevil, affected the movement of nursery stock only where shipments of tomato, potato and cabbage bedding plants from the quarantined counties is concerned.

The new Pest Control Regulation No. 4 pertaining to strawberry root weevil, while restricting the movement of strawberry plants from the quarantined area, does not materially affect growers there, as there is very little movement of strawberry plants from this area. Growers in clean districts remote from infestation, yet within the area, are able to obtain certification of shipping stock.

On July 11 Pest Control Ruling "B" with reference to prevention of spread within California of bulb pests was revised. This revision brought the provisions of the state ruling into a position more closely paralleling those of Federal Quarantine 62, which regulates the interstate movement of narcissus bulbs. This revision represented a modification with reference to provisions dealing with bulb flies, and bulb growers have indicated a desire for further modification.

DISEASE AND PEST CONTROL

Through the efforts of the Nursery Service and county horticultural commissioners, nurserymen have been given helpful information on pest control through the issuance of general and special recommendations. This assistance, coupled with nursery inspection and regulation, has enabled many nurserymen to improve the condition of their nurseries in a very commendable manner. The progress made in eliminating mealybug and scale insects has been particularly encouraging and is worthy of special note.

Following the issuance of Pest Control Regulation No. 2, particular impetus was given to the control of mealybug with a net result that several nurseries in different sections of the state were able, after much spraying and some actual destruction of stock, to pass two consecutive inspections separated by an interval of thirty days, and receive the advantage accruing to clean nurseries in being able to ship stock to clean areas without restriction other than inspection of stock at destination. The control methods used for mealybug were also productive of beneficial results in the control of other pests and particularly scale insects.

Control for Argentine ant was carried out in most cases as an aid in mealybug and scale control and many nurseries formerly heavily infested with this pest may now be considered clean. The "government" formula was generally used for this work though usually it was commercially prepared. Ant eradication programs usually have been under the direct supervision of the nursery, although sometimes handled under contract by the concerns supplying materials. Some nurseries have spent one, two or even three thousand dollars for this single item of pest control, with the total cost of similar operations for eliminating insect pests amounting, in some instances, to many times this sum for a single season.

Material progress has been made in the elimination of Dictyospermum scale from the few known infested nurseries of the state, and during the past year repeated inspections seem to indicate that it has

been eliminated from more than a quarter of the nursery premises originally infested. The following table gives the status of the work following inspections made in the spring and again in the late fall of 1927.

Dictyospermum Scale, *Chrysomphalus dictyospermi*—	*April, 1927*	*Nov., 1927*
Infestations eradicated	4	8
Apparently clean	8	8
Effectively controlled	13	11
Inadequately controlled	4	2

While probably the scale has actually been eradicated in some nurseries now indicated as apparently clean, it is planned to give at least one more very thorough inspection before considering any so listed as actually free.

Control has been by spraying or hand-scrubbing infested plants with an oil spray or resin wash. Infestations in confined spaces such as greenhouses have been handled by fumigation with cyanide gas generated from calcium cyanide.

All infestations of Dictyospermum scale reported to date are confined to sheltered locations as in lath houses or greenhouses, no authentic record of infestation having been made involving stock grown in the open.

Progress has been made in testing new means of suppressing black vine weevil *B. sulcatus*, and results from trials conducted at Eureka indicate that a very effective control may be brought about by broadcasting a poisoned bait of dried apple or dried pomace mixed with an arsenical. This material has been used effectively against strawberry weevil, *B. rugosostriatus* in northwestern states and gives promise of providing a less expensive and more effective method for these pests in California than formerly obtained with oil barriers, spraying and hand picking.

During the course of trials at Eureka it became apparent that another beetle was also present in some locations together with *B. sulcatus*, and which upon determination, proved to be *B. rugosostriatus*. This is the first report of this beetle in California since the original infestation which was eradicated several years ago.

Another pest not previously reported in California was taken at Beverly Hills and determined by Van Duzee to be the poplar leaf hopper, *Idiocerra scurra* Germar.

Progress has been made in reducing infestations of bulb pests in narcissus plantings. Practically all narcissus bulbs planted during 1926 were given hot water treatment prior to planting and in most cases nematode was eliminated from the stock, as indicated by inspection during the past season. Many plantings which have remained in the ground for two or more seasons show some nematode, but where the stock was given hot water treatment and replanted on clean ground, nematode was eliminated in nearly every instance.

Bulb fly infestation in narcissus plantings has been more difficult to cope with because the flies spread from plantings of narcissus which have remained in the ground for more than one year, thus serving to carry over the infestation from year to year. This has been most apparent in localities where quantities of bulbs were left without digging to be used for production of cut flowers. Both greater and lesser

flies were found in bulbs examined for certification but plantings in the southern portion of the state were notably free from greater fly.

In certifying narcissus bulbs for interstate shipment, county horticultural commissioners in bulb growing districts served as collaborators of the Federal Horticultural Board and rendered valuable service to growers in supplying field inspection, facilities for treating bulbs and the required certification. Regulation of intrastate movement of narcissus was also maintained for the purpose of reducing bulb pests from California plantings.

Necessary attention has been given during the year to other problems in nursery pest control and in assisting nurserymen on special problems in eliminating pests. Difficulties resulting from rejection of nursery stock moving intrastate have received attention whenever they have arisen and considerable effort has been expended in the interest of uniform application of laws and regulations affecting the intrastate movement of nursery stock.

NURSERY REGISTRATION

Nursery licenses issued during the year totaled 1629 as compared with 1628 issued the preceding year. The principal nursery counties as indicated by number of nurseries registered during the fiscal year ending June 30, 1927, are as follows:

County	*No. of registered nurseries*
Los Angeles	587
San Diego	135
Alameda	97
Santa Cruz	78
Santa Clara	74
Orange	71
San Bernardino	54
San Francisco	50

Registration to December 31, 1927, was 1565 and it is probable that the total registration for the fiscal year ending June 30, 1928, will exceed 1700.

WEED CONTROL*

PUNCTURE VINE LAW ENFORCEMENT

Uniform enforcement of the weed laws with reference to puncture vine was again discussed at the Stockton convention of the County Horticultural Commissioners Association on November 15. A special committee made the following recommendations, which were endorsed by the convention:

(1) That all counties now free of puncture vine petition for a weed free area.

(2) That all counties with limited infestations of puncture vine press control measures to the end that puncture vine weed free areas can be established for such counties or parts of such counties.

(3) That section 2323 be enforced as written to the best judgment of the commissioner, it being understood that recommendations 1 and 2 appear to suggest the best method available to inform the commissioner at destination of the puncture vine infestation conditions as they exist at origin.

A. E. Bottel, Chairman,
Whit C. Barber,
Chas. K. Turner,
Committee.

*By Ethelbert Johnson, Botanist, until October 1, 1927.

The enactment of section 2323, permitting control of the movement of articles infested with noxious weeds, affords material assistance to the campaign for the control of puncture vine. The primary sources of the spread of puncture vine are roadsides, railroad rights of way, and similar locations from which puncture vine may be picked up and carried by automobiles, animals, and a multitude of agencies beyond possible control. When the puncture vine is under control at these primary sources of infestation as it now is in many sections of the state, the next most important source of its introduction into new localities is through the movement of infested products. The products most likely to carry viable puncture vine burs in quantity are alfalfa hay and the uncomposted manure from stock corrals where infested alfalfa hay has been fed. In a number of counties, the systematic inspection of shipments of alfalfa hay and other products into the county has been inaugurated.

ORGANIZATION

The plan of coordinating the work of puncture vine control in groups of counties was begun in 1926 in southern California and in the San Joaquin Valley, the two areas principally affected by the campaign. This plan was extended in 1927 to the Sacramento Valley and the Central Coast county groups.

Meetings of representatives of interested agencies were held in Oroville on May 6 and in San Jose on July 13 to formulate plans for each of these two groups of counties respectively. At the Oroville meetings, the basic plan of statewide action already in operation in other sections was endorsed.[1]

The Butte County puncture vine project was approved as a basis for similar projects in other counties. A standing committee was organized, consisting of a representative of each interested agency, and its duties defined as follows:

"To stimulate interest in the control of puncture vine in the Sacramento Valley where progress is not satisfactory.

"To secure the cooperation of agencies directly or indirectly affected.

"To assist the horticultural commissioners in every practicable way in the control of puncture vine."

At the San Jose meeting, similar action was taken, and in addition, a special resolution was adopted calling upon the supervisors in the heavily infested counties to take steps to control puncture vine on county roads, airports, and similar important sources of spread to the end that the Coast counties with which they had important transportation connections be protected against a weed pest from which they were comparatively free.

DEGREE OF INFESTATION

The results of the 1926 campaign for the control of puncture vine were quite encouraging. The normal germination of puncture vine throughout the state was delayed on account of unfavorable weather conditions, and in some sections the total infestation was appreciably lighter than in previous years; but the germination on patches which had been oil sprayed the previous year, especially those patches which received more than one treatment, was so light that there was

[1]Johnson, E., in 6th Rept. Cal. Dept. Agr. Mo. Bull., Vol. XIV No. 7-12, 1925.

no doubt as to the efficacy of the treatment. Individual germination tests of treated burs sometimes show 20 per cent viability; furthermore, the material is applied only to the vines and burs on the surface of the soil and does not penetrate to the burs beneath the surface. There is sufficient evidence that the treatment may have some effect beyond that resulting from physical contact of the material with the burs to suggest the value of further study.

Early rains in the fall of 1927, followed by warm weather, caused myriads of puncture vine plants to sprout in many districts, but these plants were destroyed by frost before maturity.

An inspection for puncture vine was made of overflow lands along Cottonwood Creek and the Sacramento River below the mouth of the creek. The flood waters of the previous season had passed over an infested area along the creek and presumably carried away some of the burs. Occasional plants, widely scattered, were located in the overflowed area and destroyed.

A questionnaire addressed to the horticultural commissioner indicated a total infested area in the state of 666,418 acres. Of the 50 counties reporting, infestation is unknown in ten: El Dorado, Humboldt, Lake, Marin, Nevada, San Francisco, San Mateo, Tuolumne, Lassen and Modoc. Three counties, Santa Cruz, Santa Barbara and Alameda, reported all known infestations eradicated. Four counties, Fresno, Kern, Tulare and Kings, reported puncture vine not controlled, and the remaining 24 reported it as under control: Butte, Calaveras, Colusa, Contra Costa, Imperial, Inyo, Los Angeles, Mendocino, Merced, Monterey, Napa, Orange, Riverside, Sacramento, San Diego, San Luis Obispo, Santa Clara, Siskiyou, Solano, Sonoma, Stanislaus, Tehama, Ventura and Yuba.

There was expended for oil sprays used by the horticultural commissioners in the control of puncture vine the total sum of $113,155.31. No figures are available on expenditures by private individuals.

WEED SPRAYING EQUIPMENT

A tabulation of equipment available for puncture vine control in the various counties of the state indicates that there were available for use 43 power sprayers and about 320 hand sprayers. A small rotary gear pump is used in many of the power sprayers operated for puncture vine control and has been generally satisfactory. It is capable of delivering a large volume of material at a pressure of 75 to 100 pounds, which is for the most part sufficient for weed spraying. Its low cost compared with other types of pumps is its principal advantage.

HERBICIDES

DIESEL AND OTHER OILS

The extensive use of Diesel oil for puncture vine control has presented a number of problems in securing the most efficient and economical results with this material. Some of the problems resulting from the use of Diesel oil emulsions in 1926 were discussed in the MONTHLY BULLETIN for January, 1927, page 15. A report on the results of further observations on this and other materials was prepared for the

Commissioners Convention at Stockton to be published in the MONTHLY BULLETIN. The conclusions from these observations on the use of oil are, briefly:

1. Diesel oil containing not less than 2 nor more than 5 per cent asphaltum is satisfactory for puncture vine control, and forms a satisfactory emulsion with water without the addition of any substance as emulsifier or spreader.

2. Oils containing less than 2 per cent asphaltum do not form a satisfactory type of emulsion without the use of an emulsifier.

3. Oils containing more than 5 per cent asphaltum form an emulsion which, on continued agitation, may become too thick for spraying.

4. Low grade petroleum products of a large range of specifications when used alone are satisfactory for puncture vine control.

5. Petroleum fractions containing a large proportion of unsaturates are highly toxic to plants, and may be used in greater dilution than other grades of oil.

6. Oils and oil emulsions are most effective when used in hot, dry weather.

ARSENICALS

The use of weed killers containing arsenic acid has received considerable attention for several years because of the fact that it has been demonstrated that under certain conditions when sprayed on the tops of morning glory and other plants, it may penetrate and kill the deeper roots. A test of four different arsenical preparations on Russian knapweed, reported in the MONTHLY BULLETIN for September, 1927, page 500, indicates the superiority of arsenic acid over other forms of arsenic. Later tests have further substantiated these results. An exhaustive test of chemicals for the destruction of cacti was made in Australia, from which it was concluded that "for poisoning prickly-pear by either injection or spray methods, there is no doubt that arsenic acid is superior to all other chemical specifics."[1]

Reports of the Australian work usually refer to the chemical as arsenic pentoxide, which is the anhydrous form of arsenic acid. Arsenic pentoxide is a crystalline substance obtained by heating crystalline arsenic acid to a red heat. When dissolved in water, the pentoxide again becomes arsenic acid. Pure arsenic acid is a white crystalline substance very soluble in water which, on exposure to the air, absorbs moisture and dissolves. Arsenic acid is easily made by oxidizing white arsenic with nitric acid, but provison must be made for collecting and utilizing the fumes given off in the process. A technical grade of arsenic acid, consisting of a thick, sirupy liquid containing 70 to 75 per cent arsenic acid, is used in the manufacture of lead arsenate, and may be obtained at a relatively low cost from manufacturers of that product. It is very heavy, weighing approximately 13 pounds per gallon, but a dilution of one to one and one-half gallons to 100 gallons of water is sufficient strength to kill most vegetation with which it comes in contact, and under certain conditions, to kill the underground parts of certain weeds by remote penetration.

[1] White-Haney, Jean—Report of the Officer in Charge of the Prickly Pear Experimental Station, Dulacca, from 1st May, 1915, to 30th June, 1916, p. 35.

CAMELS' THORN

The patches of camels' thorn in the Coachella Valley, which had been fallowed for one full season in addition to the preliminary work of clearing and preparation begun in 1925, were allowed to grow for a short time in the spring in order to note the limits of the remaining infestation. It was found that the area of infestation had been reduced by approximately one-half. The remaining infestation consisted of a fairly vigorous growth on the spot of the original infestation, gradually diminishing toward the outer edges of the patch. It was apparent that the more recent growth had been destroyed and that the reserve energy stored in the older roots had not yet been exhausted. An examination of the roots showed that most of the plants which appeared were connected with deep vertical roots, and that the mass of lateral horizontal roots which had originally filled the soil had disappeared. The fallow treatment was continued on the remaining infestation during the 1927 season. A few plants were successfully treated with carbon bisulphide, and it is planned to experiment with this material on a more extensive scale in 1928.

Several patches in the Imperial Valley were kept under water, resulting in the destruction of a considerable proportion of roots, and causing seeds to germinate in abundance when the water was withdrawn. It would appear from a consideration of all attempts at eradication that the most efficient procedure would consist of clearing the land and flooding during the first year, deep plowing the second year, and the third if necessary, and treatment with carbon bisulphide to complete the eradication.

Two new infestations of camels' thorn were discovered in the Coachella Valley and one in the Imperial Valley during 1927.

SPINY DOCK *(Emex spinosus)*

It is questionable whether this species may be considered a noxious weed. The spines on the burs make it disagreeable to handle, and although it succumbs readily to cultivation, its habit of growing under the trees makes it difficult to eliminate from an orchard. On the other hand, it forms a bulky and succulent winter and spring cover crop which is easily worked into the soil either green or dry. No record has been found of its noxious character elsewhere, but a related species, *E. australis*, is said to be troublesome in grazing lands in Australia.[1]

AEGILOPS TRIUNCIALES

This is a grass closely related to the cultivated wheat, and supposed to be one of the species from which the primitive wheats were derived. It has become established in a small area in Calaveras County, presumably having been introduced in the wool of imported sheep. It has not been reported as established elsewhere in America, but has been used in wheat breeding experiments.

The heads are barbed, and behave somewhat like foxtail beards, but are heavier and sharper. It appears to be a very serious menace to grazing lands, as it inflicts severe injuries on livestock. The eyes and mouths of sheep which have grazed on the infested area have been punctured by these beards. The generic name, in fact, is derived from Greek roots meaning a fistula of the eye.

[1]Kirk, T. W., New Zealand Dept. Agr. Leaflets for Farmers, No. 7, 1893.

RODENT CONTROL*

Developing new methods and revising some of the older methods for ground squirrel control after detailed studies of seasonal habits and life histories in the field proved a very important project. F. E. Garlough, in charge of eradication methods in California for the U. S. Biological Survey, aided by county horticultural commissioners and department representatives, carried on the necessary investigations. Evidence of failures in the continued utilization of the older methods has been growing, indicating that in some points, at least, they were inadequate. This led to determined effort to uncover the difficulties, inasmuch as the methods had previously been effective. Whether it was a change in the ground squirrels' feeding habits or whether they were becoming wise to the types of poison in use was a question.

Unquestionably, the ground squirrel population of California has been greatly reduced, but this did not bring about eradication over much of the treated acreage. In the few cases where eradication was actually accomplished it was the result of very intensive follow up work and at considerable expense.

Periods of the year showed up a dormancy due, perhaps, to unfavorable climatic circumstances or to lack of food supply. Special attention was paid to hibernation and aestivation habits of ground squirrels in an effort to determine when these periods occurred, what induced them, and whether or not it was advisable to cease all control operations for certain periods. This study will be continued by the "eradication methods laboratory representative" along with his tests of new materials until a method which will effectively supplement methods now in vogue has been worked out.

Cooperative drives against ground squirrels in areas in northern California were continued. These drives, which take place annually in some sections, prove valuable where agricultural areas are surrounded by much grazing and government controlled lands. The federal rodent leader has provision for furnishing poisoned grain for these national domain areas and a very appreciable reduction in squirrels is noticed in these farming properties. The advantage exists primarily in having a proper material at a proper season of the year under the supervision of a county, state, or federal employee experienced in control methods.

A still further improvement and one more practical for the agricultural areas of the state is the development of a county crew system of squirrel control, by which the county horticultural commissioner obtains agreement from the property owners to reimburse for any outlay for materials and labor when this trained and experienced crew operates over his property. A modification of this plan permits a land owner to furnish part or all of the labor for the crew when his acreage is extensive. This is not as satisfactory as a crew employed strictly under county supervision, although the foreman is always an experienced supervisor. Wherever this crew method has been employed more uniform and lasting results have been obtained.

The total estimated area where squirrel infestation warrants control measures is approximately 12,000,000 acres. During the year about 3,750,000 acres were treated, of which 175,660 acres were federal lands

*Joint report by W. C. Jacobsen; Norman G. Buhn, Superintendent of Rodent Control, resigned, and C. Olsen, successor.

treated either by Biological Survey representatives or by land owners to whom poison was furnished without cost. In the state there were used approximately 889 tons of poisoned grain and 355 tons of fumigants, most of which were distributed by county horticultural commissioners at cost, while much of the poisoned grain was prepared by the county officers. These figures are taken from the annual reports of the county horticultural commissioners. The Biological Survey representative cooperating with the state and county men has estimated a total of $2,500,000 saving as a result of the use of these materials.

Thallium sulphate as a lethal agent on grain bait has developed into an important poison. It has proved very effective during the spring months but has limitations preventing its general use throughout the year. The limited supply of this material plus the danger of handling by some one not trained in its use make continued control of its distribution and exposure by county horticultural commissioners or state or federal agencies imperative. It is material well adapted to use by county crews where the men exposing the poison are under supervision at all times. When properly prepared and applied, there is no danger of fatalities to game birds, which has been one of the chief criticisms of the method. This material is used on potted barley from February until April, when green feed makes the use of other grains impractical and when it is beginning to be late in the season for carbon bisulphide fumigation. Thallium poisoned grain is to be considered a supplement to the other methods and not in any sense a substitute.

During the year several foci of plague infection among ground squirrels were reported by the director of the Department of Public Health. This information was transmitted to county horticultural commissioners, who took immediate steps in intensive rodent control operations.

In some of the eastern states information appeared that Tularemia was quite prevalent. This disease was noted in California from rabbit as a plague-like disease during the period (1908-1912) of intensive operations by federal and state health agencies in suppressing bubonic plague among squirrels and rats. Tularemia has not seemed very widespread among rodents in California although originally described from this state.

A number of sections requested special assistance in rat control, apparently appreciable damage having been occasioned in warehouses and to agricultural commodities where regular rat control procedure was not already undertaken by local health agencies.

An outstanding event in the year was the outbreak of house and meadow mice in Kern County, touched upon in other numbers of the MONTHLY BULLETIN.

PREDATORY ANIMAL CONTROL*

The past six years have witnessed a great improvement in the predatory animal situation and, while there are still losses among live stock and poultry, also to game animals and birds, from the activities of

*Joint report by W. C. Jacobsen and Chas. G. Poole, State Leader, U. S. Bureau of Biological Survey.

predatory animals, these are spasmodic rather than perpetual occurrences, showing a material decrease in the year's aggregate. Considering that there has been a very large increase in the number of sheep acquired and maintained by old owners, and a large number of new owners starting in the business during the year on the strength of the very apparent reduction in the per cent of mortality due to coyotes, cats, etc., the result of the year's work appears to be satisfactory. While numbers of stock have increased, losses have decreased from those sustained in previous years. If the losses totaled as great as in the past it would show a lessening in percentage because of the increase in stock. From available information there appears to be a vast improvement in curtailing losses to game animals and birds in the territories where control operations have been carried on. Fawn deer in plentiful numbers are in evidence where in many years past there were few. The same applies to quail. The small herds of antelope in Siskiyou and Modoc counties are increasing and showed a very good percentage of fawns during the past year.

From one to three men, paid from federal and state funds jointly, are generally kept in these territories throughout the year for the protection of antelope and mule deer in conjunction with stock protection, especially to keep that area clear of rabies. With a marked increase in game, with far less mortality among live stock, and with no cases of rabies reported in that vicinity during the year, it would seem that the expense incurred in keeping a man year-long and one or two temporarily assigned during the proper periods, is entirely justified both for economic and health safety reasons.

One of the most outstanding results of predatory animal control work is in Imperial Valley in the vicinities of Calipatria, Brawley, Westmoreland and Holtville, where the raising of thousands of lambs and the successful feeding of thousands of others shipped in from New Mexico, Arizona and other states for late winter and early spring markets, is now possible. Practically no losses have been sustained this year, while before our work started, coyotes were so active that it was impossible to carry on this industry. The work is financed by the state, federal government and stockmen on a cooperative basis for a four months' period.

Operations were carried on intensively during the year in the following counties:

Alameda	$2,500 00
Amador	1,000 00
Butte	2,500 00
Calaveras	1,750 00
Contra Costa	1,620 00
El Dorado	1,435 00
Glenn	2,400 00
Humboldt	4,322 00
Imperial	amount necessary
Kern	3,000 00
Lake	2,000 00
Madera	1,000 00
Marin	1,000 00
Mariposa	125 00
Mendocino	8,195 73
Modoc	2,071 34
Monterey	1,000 00

Napa	$2,500 00
Nevada	375 00
Sacramento	amount necessary
San Joaquin	1,500 00
San Mateo	1,500 00
Solano	500 00
Sonoma	2,500 00
Yolo	amount necessary
Yuba	1,000 00

All are counties where we have operated for five or six successive years, excepting Madera, Butte, San Mateo, Marin, and Mariposa, which entered into cooperative agreements during the year. Other counties desired work done, but as their requests were received long after all available funds, state and federal, had been allocated, with no possibility of change, we could not comply with them. Funds for salaries and necessary travel expenses for field supervisors assigned to the several districts were inadequate for broader operations. The fact that the counties and the stock associations should bear the greater part of the hunter salary burden, with the state and federal government funds being used primarily for supervision expense, is emphasized by this situation. Adequate supervision, which is vital to the efficient and economical carrying on of the work, should be the principal function of the governmental agencies and should be accepted by the stockmen and other interested parties as at least equal cooperation. Some counties have accepted this policy as being fair and equitable while others contend that the state and government should in all cases work on a fifty-fifty basis as regards hunters' salaries and supervision expenses and supplies for good measure.

With a few exceptions the counties north of a line running east and west through Sacramento are carrying out a systematic program, while south of this line the work is spotty and disjointed. This latter type results in a lack of permanent accomplishment and is at best little more than a demonstration and mediocre form of insurance. Lasting results are desirable, of course, and can be obtained only by concerted effort applied to an entire territory. An endeavor is being made to bring this about. In spite of any shortcomings in the present situation, it is claimed by stockmen that great savings against loss have been made and that there must be no cessation of the work even in its present form.

Number of predatory animals accounted for from January 1 to December 31, 1927, was 4630. This number can be doubled in the case of coyotes, since where poison is used few of the dead animals are found. Approximately 2200 ounces of strychnine special poison were used in the poison operations.

There was an average of 57 state and county paid hunters working throughout the year, with two supervisors paid from state funds. The leader, assistant leader, junior leader and one supervisor on an annual basis were paid from federal funds by the United States Biological Survey.

The total cost of operations was (exclusive of commissioned federal officials) $84,926.35, divided as follows: state $35,624.23; federal $15,712; county $42,368; wool growers $1,221.

It is impossible to even approximate definitely the savings to stock and poultry men because of this work. It is probably somewhere near $1,000, and if we take into consideration the increased valuation of lands made tenable for grazing purposes through killing of predatory animals and the increase in sheep and poultry because of general confidence, these figures will be materially increased.

APIARY INSPECTION*

History tells us that in 1852 two men, J. S. Buckley and J. S. Harbison, brought to California the beginnings of our present great apicultural industry. In keeping with the present migratory nature of the industry, these first colonies made the trip from New York around the Horn to San Francisco.

From this small beginning, the 1900 census shows us that the industry had grown to 129,444 colonies, and ten years later had exceeded 200,000, until now California is recognized as the foremost state in both bee population and honey production.

The present estimated population of 300,000 colonies represents a capital investment of about $7,000,000 and an annual production of around 15,000,000 pounds of honey, as well as wax, queen bees and package bees, giving a gross income value of around $1,500,000. This bespeaks a profitable and congenial atmosphere for honey production.

The monetary value of the industry to California can not be estimated in income alone, since bees present an even greater value as the chief pollination agents of California's million and a half acres of fruit and vegetables. In early days, horticultural plantings were widely scattered. The native insect fauna was then quite sufficient to care for pollination needs, but now, with great concentrated plantings accompanied by a comparative decrease of native flora and fauna, the apicultural industry has taken over the burden of pollination and is now an indispensable part of our scheme of agriculture. This fact, often overlooked, is in itself a real justification for liberal state protection of the industry.

The apicultural industry of California is still capable of much expansion. Millions of pounds of nectar are still going to waste and such congenial locations, where honey bees can fly the year round and nectar-flows are abundant, are known in few other places; but the industry is faced with some great problems which, however, are not insurmountable. Among these are more effective marketing and more economical production. While marketing is out of the realm of this bureau, economical production through disease control is not. An important obstacle is the presence of disease throughout the apiaries of the state which takes an annual toll of at least 10 per cent of the colonies, largely due to "American foulbrood."

The bee industry, by agency of the 1927 legislature, vested the Department of Agriculture and the county horticultural commissioners with the problem of cleaning up the disease. Apiary inspection has now been a function of the Department for five months, during which time a survey of the industry has shown some of the essential prob-

*By Frank E. Todd, Entomologist, Sacramento.

lems. A clean-cut program for the elimination of American foulbrood from the state has been prepared, the essential elements of which are:

1. Complete registration, which is, in effect, a detailed survey of the industry.

2. Organization of the work for the issuance of reliable Certificates of Inspection.

3. Laying the ground work for campaigns for the eradication of American foulbrood in each county.

The enactment of the new bee law technically gave fifty counties of the state ex officio state bee inspectors in the persons of the horticultural commissioners. Thirty-one additional county inspectors of apiaries have been appointed, making a total of eighty-one persons working for the good of apiary inspection in the various counties of the state, and the various counties have made available $38,000 for paying these inspectors and carrying on the work. Registrations received from thirty-four counties have given a total of 228,000 colonies, with good assurance that the number will exceed 300,000.

The problem of quick and reliable diagnosis of disease samples has been cared for through the courtesy of the animal pathology laboratory, twenty-five samples having already been diagnosed.

Beekeepers generally have sanctioned the change of policy from the former method of treating American foulbrood by the "shaking" method to that of burning diseased colonies, which is now generally recognized as the only method by which American foulbrood has ever been eradicated from any area.

WHITE PINE BLISTER RUST*

Eleven counties were rid of cultivated black currants this season, as follows: Marin, Sacramento (city excepted), San Joaquin, Contra Costa, Stanislaus, Merced, Madera, Fresno, Kings, Tulare and Inyo. Sixty-seven plantings, comprising 335 bushes, were found. This territory, mainly in the San Joaquin Valley, was not particularly conducive to the growth of currants of any kind.

Since the eradication work was started in 1924, 41 counties have been completed, with a total of 651 plantings, comprising 3921 bushes. In addition, 29 nurseries have removed 4979 bushes.

The eradication of wild currant and gooseberry bushes in certain sugar pine areas in the Stanislaus National Forest was completed over 3536 acres with a cost of approximately $2 per acre. An average of 59 Ribes (currants and gooseberries) per acre was found, ranging from a minimum of 6.7 per acre in open sugar pine, yellow pine type, to a maximum of 642.2 bushes per acre on stream-cutover type. This work, still in an experimental stage, seems to be paving the way for a practical method of protecting certain valuable sugar pine sites.

Through control reconnaissance work determination was made of the location and extent of sugar pine timber types, the amount of timber and reproduction present, the occurrence and distribution of Ribes, and physical factors affecting costs and methods of local control. This reconnaissance will give a comprehensive plan for the application of

*Compiled by G. A. Root, U. S. Office of Blister Rust Control, Sacramento, California.

local control with an estimate of the time and money necessary. Data have been obtained on approximately the entire Stanislaus National Forest.

In the chemical eradication of Ribes, an important development is the proven feasibility of the eradication of wild currants and gooseberries by spraying with chemicals. This method will be cheaper and more effective than hand pulling in stream bottoms or other places where the bushes grow in profusion. Much of this work has been carried on in northern Idaho, but a start was made in the Stanislaus National Forest in 1927. A 100 per cent kill was not obtained on two of the most numerous and important Ribes in the sugar pine belt, but it is hoped that this will be attained with further experimentation on strength of spray to be used and application of the same. Of over thirty different chemicals used, sodium chlorate ($NaClO_3$) has proved the most effective in its killing power.

Of added interest has been the development of a light portable power sprayer, one which can be transported easily on a horse, or if necessity demands, by man. This outfit has been developed from a portable fire pumper, a type which has been in use for some years in fighting forest fires.

PROGRESS IN CITRUS WHITE FLY SUPPRESSION IN THE NORTHERN CALIFORNIA AREAS

By D. B. Mackie, Entomologist, Sacramento

EARLY in 1924 a movement was started by representatives of the citrus industry looking to the eradication from California of the citrus white fly, *Dialeurodes citri.*

This interest culminated in the state legislature, at its session of 1925, enacting a law providing for the eradication of the insect either by destruction or treatment of its host plants.

As finally approved by the Governor, an appropriation of $40,000 was made by the state, contingent upon a like sum being available from the citrus interests.

To obtain a better idea of the situation in regard to this insect, there are certain facts pertaining to its course in California that may help to bring about a better understanding.

Though it has been in California for over twenty years, practically all of the infested areas are in and about residential sections.

Soon after its appearance about 1906, eradication was attempted by means of cutting back or removal of all host plants. Although presumably eradicated by this method in Oroville, in Marysville there seems to have been considerable misdirected effort due to disregard of the seasonal stage of the fly, thus causing local public sentiment to be built up against the state's program.

It can not be denied that the record of white fly in Florida caused concern in the orange belt, yet in the infested areas in California little or no concern was felt by those whose properties were invaded. This fact was brought out in the meetings of a committee composed of representatives from the infected cities appointed by the director in 1925.

It was believed by the proponents of the undertaking mentioned that a material reduction and less hazard offered the only [illegible] solution could be accomplished. Did—a justice to the idea—no other more useful alternative was offered.

The method involved the question of the destruction of one tract's property without compensation for the benefit of another, located at a distance, with a bulk of the other property under hundreds of miles away, presenting a [illegible] legal question of constitutional rights. This fact had not been lost sight of by many property holders and the case investigated by the State Board of Control, which was influenced to authorize expenditures of funds under a program that [illegible] be declared unconstitutional. Upon being charged with the responsibility of carrying out the provisions of any legislation of such nature, it behooved the Department to be fully advised as to just where its powers, [illegible] duties to [illegible] and what would be the possible consequences.

The Department felt that under existing conditions the effects of the methods proposed and also their adaptability to the problem at hand might be doubted.

The [illegible] suggested was under the project was a series of tests with [illegible] materials. These included:

1. [illegible] group
2. [illegible] group
3. Oil [illegible] group
4. Wood [illegible] group

In these experiments a wide range of [illegible] material and several [illegible] were [illegible] be required. These produced a wide range of results, some of which were [illegible]. These gave evidence of [illegible] [illegible] to [illegible].

A number of property [illegible] owned [illegible] have now established [illegible] company, also were sold by [illegible]. The [illegible] brought out by [illegible] [illegible] [illegible] [illegible] would be considerably [illegible], particularly a [illegible] of the [illegible] [illegible] [illegible] to the Director of [illegible] to be certain things, to [illegible] penalty was provided for those who [illegible] the [illegible] taken by the [illegible]. In [illegible] to these problems, the [illegible] Commissioners [illegible] have a most responsible [illegible] of [illegible].

In [illegible] a [illegible] of these conditions, a [illegible] was [illegible], [illegible] to [illegible] the [illegible] of the [illegible]. In this case a representative of the State Department of [illegible] wanted to remove a [illegible] bridge. [illegible] [illegible] was sought and granted and the case taken [illegible]. It was [illegible] that the property on which the [illegible] was [illegible] was not actually [illegible], but was within the [illegible] [illegible] [illegible], and not by [illegible] [illegible]. The court ruled that no such a thing as the [illegible] of [illegible] could legally be held, and that before any [illegible] of [illegible] could be [illegible], the [illegible] [illegible] would have [illegible] be [illegible].

The act of the Department in [illegible] a [illegible] property for a test has [illegible] criticized. It is the writer's opinion that failure to [illegible] would [illegible] be a test that would [illegible] [illegible].

[illegible] of endeavor with the result that extensive proceedings under [illegible] brought where a material compliance was in fact being secured, at most a case would have been dismissed.

On December 16, 1936, in Washington, a meeting was called for the purpose of drafting some rules of procedure. The case control committee representing the Citrus Leagues met with the members of the State Department of Agriculture, the Entomological staff of the University of California and the U. S. Department of Agriculture, the latter being represented by Dr. A. C. Baker, Chief of the Division of Tropical and Subtropical Fruit Investigations.

There followed upgrading the dressers of the local court and self-styled[illegible] a material challenge by counsel at bar. No personal matter and a case of public importance, not only because of [illegible] but mainly from the standpoint of a problem in [illegible] importance to the industries were based upon the fact that recent investigations of the Department of Agriculture had revealed a new [illegible] to prevent this overflowing harvest, and that a campaign of the nature would require the withholding of every [illegible] material in the infected territory. When it was pointed out that no evidence existed showing that all [illegible] had been treated,

As a matter of record, the carrying movement was held that regardless of [illegible] their power or duty. Should growers wish to be satisfied [illegible] they might get anything on the back. We have plenty of the white fly to be [illegible] to work with. The statement was predicated upon the fact that under the conditions of its existence a large number of [illegible] would be found, and that consequently the number of plants produced was a great [illegible] where many would be overlooked.

It was decided that procedure should be on the nature of a campaign [illegible] the reducing of the white fly to a minimum of activity, to the Department of Agriculture and that work should start at once with an [illegible] in Sacramento and Marysville areas. Following the agreement as to method we immediately started [illegible] to an organization [illegible] have not yet changed this.

For the purpose of coordination the district was divided into two parts:

1. The northern district, comprising Marysville-Yuba City, with [illegible] in charge.
2. The Sacramento district with C. L. Lewis, Assistant Entomologist in charge.

Frank E. Todd as entomologist of extensive training assumed general supervision under us [illegible].

A campaign of spraying, after the most propitious of existing [illegible] reduction of white fly population. At the [illegible] January 1, 1937, the main assignment of the department was a [illegible] survey, a large [illegible] determine the number per [illegible] which [illegible] with [illegible], and this was found to [illegible].

The legal [illegible] [illegible] are [illegible] with information [illegible] to conduct spraying, [illegible] dealing with spraying campaigns in residential property a [illegible] to [illegible].

By means of the following [illegible] the [illegible] group, a [illegible] [illegible] of plants to be sprayed [illegible] of necessity to be prepared, including

such species upon which white fly larvae had actually been found, also such species as by reason of habits of growth and foliage texture might lend themselves to infestation.

A number of plants, while conforming in many respects to species included in the list, were not included because continued inspection under the most favorable locations failed to show any signs of white fly. As prepared, the potential host list included 114 species of plants. This number, it was felt, circumscribed all probable hosts.

The next move placed trained inspectors in the field to establish the degree of infestation. To be of value this data would have to be on a sufficient scale to be representative. The results of these counts appear later.

To provide proper equipment six sprayers of the largest capacities available were purchased. These included two Bean Quads 35's, two Friend 25's, one Hardy Mogul 25, one Fitzhenry Guptill AA Special 50, and two 1½ ton supply trucks. Two of the sprayers were motor mounted, the rest being on trailers.

Due to the fact that oil sprays leave a dirty smudge on paint, it became necessary to design and have made to order special large canvas and special gear to swing same to protect houses against spray.

All members of the supervising staff were educated in the identification of this host group. The interim before the arrival of equipment made possible the testing out of commercial spray formulas, an oil spray being conceded the best adapted, due to the sulfur group turning paint black and also being hard on operators.

These experiments indicated that a 2% solution of a number of the higher grade summer oils killed all stages of white fly with which they came in direct contact. The question thus resolved itself into a campaign of careful spraying, it being early evident that the success achieved would be largely measured by the thoroughness with which spray material was applied.

As the different sprayers arrived, crews and accessories were brought to their full complement, which by March 21 consisted of

1 Entomologist, supervisor
1 Assistant entomologist, assistant supervisor
2 Inspectors
1 General foreman
7 Operator foremen
2 Canvas foremen
16 Nozzlemen
16 Hose pullers
10 Canvas men
1 Checker

Unforeseen obstacles began to present themselves with the beginning of operations, perhaps the greatest difficulty being the great variance in the growth habits of the different members of this host group, with extreme types often on the same property. Such conditions made necessary frequent changes in sprayer accessories and the equipment of each crew with all types including spray poles, spray guns and Worthley nozzle (solid stream). Host plant growth, even with one species of vines, ivy, varied from procumbent growth to climbing of large trees to a height of 75 feet or more, with all grades between.

Counts made on changes in accessories showed these to have varied from thirty-six to seventy-five times in an eight hour day. Despite the fact that quick detachable couplings are supplied, the interchange cannot be accomplished in less than one minute per change and this only under the most propitious circumstances. The time lost through this circumstance alone has been great, while it is even more far reaching in indirect results in spraying efficiency.

This switching of accessories developed a tendency on the part of nozzlemen to use whatever type was attached rather than make the necessary replacement. This could not but affect efficiency in direct ratio to which it was practiced. The designing of an accessory to obviate the necessity of change solved this difficulty.

Other conditions, control of which is impossible, include in order of importance, wind, rain and fog.

The former is by far the most difficult to figure. Its effect varies with the position of each sprayer and almost with each property. To gauge the limit of wind velocity detrimental to spraying was a most difficult matter particularly when the time element was so vital.

Rain storms develop suddenly. Their effects are definite, however, as investigation made possible the establishment of a time limit within which it was safe to spray and after which respraying was advisable.

The effects of fog were merely to delay spraying until surface moisture had evaporated.

The above are a few of the most persistent troubles. On January 1, 1927, the potential host index previously mentioned, including a number of new hosts found in 1926, showed 17 evergreen and 11 deciduous hosts, totaling 28. On March 31, a total of 54 hosts included 43 evergreen and 11 deciduous. As revised later the following list was developed:

CALIFORNIA CITRUS WHITE FLY HOST PLANTS*

Revised to May 13, 1927

Genera	*Species*	*Common Names*
Aucuba	japonica	Gold Dust plant
Bignonia	Venusta	Trumpet creeper
Buxus	sempervirens	Box
Buxus	japonica	Japanese box
Camellia	japonica	Camellia
Choisya	ternata	Mexican orange
Citrus	aurantifolia	Lime
Citrus	aurantium	Seville orange
Citrus	deliciosa	Tangerine
Citrus	grandis	Grapefruit
Citrus	limonia	Lemon
Citrus	media	Citron
Citrus	sinensis	Orange
Coprosma	Baueri	Coprosma
Escallonia	montevidensis	Escallonia
Escallonia	rosea	Escallonia
Escallonia	rubra	Escallonia
Fortunella	japonica	Kumquat
Gardenia	florida	Cape jasmine
Hedera	helix	English ivy

*The names in this list have been corrected to conform to "Standardized Plant Names" published by the American Joint Committee on Horticultural Nomenclature, 1923.

Genera	*Species*	*Common Names*
Ilex	aquifolium	Jasmine (yellow)
Jasminum	sp.	Grecian laurel
Laurus	nobilis	English holly
Laurocerasus	lousitanica	Portugal laurel
Laurocerasus	officinalis	English cherry laurel
Ligustrum	japonicum	Japanese privet
Ligustrum	lucidum	Glossy privet
Ligustrum	ovalifolium	California privet
Ligustrum	Vulgare	European privet
Mahonia	aquifolium	Oregon holly grapes
Photinia	arbutifolia	Toyon
Pelargoneum	peltatum	Ivy leaf geranium
Pyracantha	coccinea	Firethorn (scarlet)
Pyracantha	angustifolia	Firethorn (narrow leaf)
Rosa	spp.	Roses
Veronica	anderson	Veronica
Veronica	elliptica	Veronica
Veronica	speciosa andersoni	Veronica
Veronica	spp.	Veronica
Viburnum	tinus	Laurustinus

DECIDUOUS

Ailanthus	glandulosa	Tree of Heaven
Amelopsis	tricuspidata	Boston ivy
Crataegus	monogyna Paulii	Hawthorne (double scarlet)
Crataegus	oxyacantha	English hawthorn
Cydonia	japonica	Flowering quince
Diospyros	kaki	Japanese persimmon
Diospyros	virgiana	Native persimmon
Malus	sylvestris	Apple
Melia	azedarach-umbraculiformis	Texas umbrella tree
Punica	granatum	Pomegranate
Syringa	vulgaris	Lilac
Vitis	vinifera	Grape

EVERGREEN

		Dead Specimens Found on
Aspidistra	lurida	Aspidistra
Cytromium	falcatum	Holly fern
Ficus	elastica	Rubber plant
Rubus	sp.	Blackberry
Zantedeschia	aethiopica	Calla

It is interesting to note that no species not incorporated in our potential list of 114 has been found to carry infestation, thus nothing was overlooked.

Despite the numerous unavoidable obstacles met, by dint of working long hours, the 310 blocks in Sacramento recorded as infested, together with the four known spot infestations, were completed within the time limit set as probable for adult emergence.

Much to our chagrin inspectors working in advance of spray crews showed infestation established beyond the areas believed to comprise the infestation. Before the work in Sacramento was completed for the season it was necessary to spray 856 city blocks, more than two and a half times the supposed area.

In the northern district somewhat the same condition resulted. The day following the completion of the spraying of the Marysville-Yuba City area, white fly was found in Gridley, where it was necessary to

spray the entire city of 41 blocks. In the Sacramento area this insect was found across the Sacramento River in Broderick, Yolo County, also in North Sacramento, all of which areas were sprayed before the close of the season's campaign.

During the first winter's campaign, there were used 12,160 gallons of oil emulsion, which made 569,035 gallons of spray applied by seven sprayers operating 2665 sprayer hours or 332 sprayer days.

Immediately following completion of spraying, inspection was started to check results and also to develop information as to possible extent of infestation in outside areas. The area covered by this inspection covered 110 townships of 36 square miles each, or an area approximately 3960 square miles.

In practically all of this area, a citrus census was taken, with record of ownership, regarding and whether the trees were grown as ornamentals or commercially.

This inspection revealed a number of spot infestations outside the larger areas. These were

Butte County	2
Sutter County	11
Yuba County	4
Sacramento County	4
Yolo County	1
	22

These findings were of interest, since it established more extensive areas with living larval white fly than were believed to exist. In most of these areas infestation is light, only a few individuals being found. That they were found at all is surprising.

Of particular interest was the case in Oroville, where white fly was found at seven different points in the town. It has generally been conceded that eradication was accomplished there by the campaign of 1907, and it is difficult to say whether the present infestation is a hang-over or a new introduction. As soon as practicable, spray crews covered this spot infestation.

During July and August, 1927, all preferred hosts in blocks showing heavy infestation were summer treated.

Summer inspection brought out the fact that with the consequential reduction in white fly population due to spraying the insect remained primarily on preferred species and did not spread to such a wide range of hosts. Furthermore, there was not the marked migration to deciduous hosts, except when these were in close proximity or immediately adjacent to those of the preferred type. As a result, it has been possible to cut the host list of plants to be sprayed from 114 to 37, causing a very substantial saving in material and labor.

PLANTS TO BE SPRAYED IN WHITE FLY CAMPAIGN WINTER 1927–28

November 28, 1927

Genera	*Common Names*
Aucuba	Gold Dust plant
Bignonia	Trumpet creeper
Choisya	Mexican orange
Citrus	All citrus
Coprosma	Coprosma

Genera	*Common Names*
Escallonia	All escallonia
Fortunella	Kumquat
Gardenia	Cape jasmine
Hedera	English ivy
Ilex	English holly
Jasminum	Jasmine (yellow)
Laurus	Grecian laurel
Laurocerasus	All laurocerasus
Ligustrum	All privets
Mahonia	Orange grape
Photinia	Toyon
Pyracantha	All pyracantha*
Veronica	All veronica*
Viburnum	Laurustinus

* There are certain species among the genera designated to "Spray all" as *Veronica cupresoides, Pyracantha yunnanensis*, which by their type of foliage or texture do not lend themselves to white fly infestation, hence are omitted from spraying whenever encountered.

SUPPLEMENT TO INCLUDE 1927–28 WINTER SEASON

The second winter spray campaign was started early in December, 1927. In this campaign three sprayers were located in the Sacramento area and three in the Marysville area.

Inspection had revealed the fact that it would be necessary to spray all hosts in the entire city of Sacramento. In the northern area the work included all the cities of Marysville, Yuba City, Gridley and most of Oroville, and all spot infestations, twenty in number.

As the work progressed to a point where the 831 blocks were sprayed in the first winter's campaign, a comparison of the results was made which shows the following:

COMPARISON OF SPRAYING EFFICIENCY ON BASIS OF AREA SPRAYED DURING FIRST CAMPAIGN 831 CITY BLOCKS IN SACRAMENTO

1926–27 season	Gallons used	337,335
1927–28 season	Gallons used	291,620
	Reduction	47,715
1926–27 season	Sprayer hours	1701
1927–28 season	Sprayer hours	800
	Reduction	900
1926–27 season	Output, gals. per hour	199
1927–28 season	Output, gals. per hour	364
	Increase	165
1926–27 season	Blocks covered per hour	.49
1927–28 season	Blocks covered per hour	1.04
	Increase	.55
1926–27 season	Purchase material per gallon	$0.45
1927–28 season	Purchase material per gallon	.35
	Reduction per gallon	$0.10

It will be seen that a very noticeable efficiency has been effected in many lines. These include efficiency in personnel, mechanical efficiency and better buying in supplies.

CHECK OF WHITE FLY OPERATIONS

Are Checked

	Yuba City Entire city 9 blocks	Marysville Entire city 45 blocks	Sacramento 53 heaviest of infested blocks	Averages and totals
Pre-spraying 1927				
Leaves counted	5,400	27,000	31,800	64,200
Live insects counted	105,954	1,941,336	531,162	2,578,390
Post-spraying 1928				
Leaves counted	27,000	135,000	159,000	267,900
Live insects counted	242	1,079	445	1,766
Average per leaf 1927 before spraying	19.62	71.90	16.70	36.07
Average per leaf 1928 after spraying	.0089	.0079	.0028	.0065
Reduction	99.955%	99.990%	99.983%	99.983%

This work was completed on February 15th in the Marysville area and in Sacramento and vicinity about February 28th. In Sacramento city 1559 blocks were sprayed. To this may be added North Sacramento and Broderick in Yolo County. With the completion of spraying, final checks of results obtained were started, and the tabulation above gives the summarized results of the Department's campaign.

In presenting these averages it will be noted that only 57 check blocks are listed under Sacramento. This number of blocks is utilized because the entire number checked showed only 57 in the original area of heavy infestation. With the others showing negative at this check a comparison would hardly be fair and would look even more favorable than the percentage obtained. For this reason a supplementary tabulation of the counts in Sacramento is also furnished.

SACRAMENTO (FINAL CHECK)

Total blocks inspected	167
Infested today	51
Clean	116
Total leaves examined	501,000
Live insects found	447
White fly per leaf	.00087

The above furnishes a fair idea of the steps taken to reduce the white fly population in the Sacramento-Marysville district together with results obtained. It is believed that the foundational data have been taken on a scale sufficiently extensive to be representative. In the tabulation only the barest totals appear. There exists in our files a wealth of supplementary data in great detail which give figures starting with the leaf, the tree, or the city block, or the city itself as a basis.

There have also been prepared lists of every host plant in the areas of control (not the spot infestations). To amplify, it may be said that each city block carries a number and every potential host is listed by its scientific name and variety, covering Marysville, Yuba City, Gridley, Oroville and a large part of Sacramento.

SUMMARY

In summarizing our activities against citrus white fly in Northern California it may be stated that the department:

1. Has trained and educated a force of inspectors in the identification of a large percentage of the ornamental and nonnative plants grown in the district.

2. Has caused the investigation of potential hosts and extended the known citrus white fly host group from [illegible] to [illegible] species.

3. Has made surveys covering an area over [illegible] square miles in nine counties to determine the extent of citrus white fly distribution, thereby adding [illegible] sites to the known infested territory.

4. Has assembled the necessary equipment and trained the necessary force to prosecute a successful spraying campaign covering the cities and adjacent territory.

5. Has developed spray formulas in which [illegible] gallons of material have been successfully applied in the destruction of citrus white fly throughout the area of infestation.

6. Has made some notable improvements in equipment and design of sprayers and accessories.

7. Has designed and constructed such new equipment as necessary for the more efficient prosecution of the work.

8. Has effected a reduction in the white fly population of [illegible] in the areas where work was prosecuted.

The administration of the project from January 1, [illegible], to April [illegible], [illegible], has involved the expenditure of funds in the amount of $[illegible], $[illegible] of which was contributed by the Citrus League of California, the balance of $[illegible] being appropriated by the state.

CONCLUSIONS

The foregoing indicates that the methods employed by the State Department of Agriculture have reduced the numbers of citrus white fly to a point approaching eradication.

Being without precedent, future expectancy in this connection can be based only on such information as has been brought out by our own work. The tendency of citrus white fly to remain in its preferred hosts [illegible] to host habit and the apparent inability of our best trained inspectors to find it in treated areas where light infestations had existed, furnishes evidence which might support the belief that eradication lies within the bounds of reasonable presumption, if the work is continued.

As matters now stand, we are faced with one of two alternatives. The equipment and organization available may be continued in use at the proper time with the chance that eradication can be accomplished, or it can suspend the work, in which event it will be a question of only a few years until citrus white fly can resume its former status.

BUREAU OF DAIRY CONTROL

Dr. C. U. Duckworth, Chief

THIS bureau is concerned with the maintenance of high standards of quality for dairy products, the protection of the dairy industry against abuses and fraudulent trade practices, and the compilation of dairy statistics, and is directly responsible for the enforcement of the General Dairy Law of California, the Pure Milk Law, the Certified Milk Act, the Prepared Milk Act, the Pasteurized Dairy By-Product Act, and the Containers Labeling Act, in so far as it is related to the dairy industry.

An outline of the various subdivisions of the bureau work follows:

1. MARKET MILK

The market milk program, which has come to be looked upon by producer, distributor, control official and consumer alike as an insurance policy for pure milk, has continued to expand during the past year. The direction of the development, however, has been more from within than from without; that is, while the number of new departments approved has not been as great as in some former years, the work of our market milk specialists with respect to bringing about more intensive methods of supervision of those departments already holding state approval has been greater, with the result that the quality of the graded milk supply has been improved to the extent that the average for the state during 1927 was 95.1 per cent perfect from a quality standpoint. The quality of the milk supply is determined by surprise milk scoring contests held at frequent irregular intervals throughout the year, at which time the milk is scored on the basis of 35 per cent for bacterial analysis, 15 per cent for flavor and odor, 15 per cent for butterfat, 15 per cent for solids not fat, 10 per cent for sediment, 5 per cent for acidity and 5 per cent for bottle and cap, making a total of 100 per cent.

Four local departments were approved, bringing the total to forty-nine, and extending the state grade label of quality to over two hundred and fifty cities and towns which comprise over 90 per cent of the state from the standpoint of population.

2. RECEIVING POINT INSPECTION SERVICE

Milk and cream delivered at manufacturing plants are graded for quality. The products manufactured therefrom enter into intercity, intercounty and interstate trade. Approximately twenty-five thousand dairies are engaged in the production of this class of milk. The raw materials are graded on receiving platforms on the basis of bacteriological and chemical tests. Dairies delivering undergrade products, as determined by this procedure, subsequently are visited and required to handle their products in accordance with methods which will insure high quality. Particular attention is given to the sterilization of utensils, clean milking, cooling, and protection from insects and dust contamination. At the plants special attention is given to the handling of these materials through the use of clean, sterile, dry containers, thorough and accurate pasteurization, proper refrigeration and general sanitation.

An agreement was entered into during the past year between this bureau and the Bureau of Agricultural Economics of the United States

Department of Agriculture, whereby the milk and cream grading for manufacturing purposes would be carried out under a program to be known as the "Federal-State Market News and Grading Service." The grading work is voluntary and self-supporting; hence, its existence depends wholly upon the ability to obtain satisfactory results. The fact that two new projects were established during the year in Siskiyou and Monterey counties, is an indication of the recognition of its merits by the dairy industry. A detailed discussion of this work will be found in a special article elsewhere in this publication.

3. BUTTER CONTROL

Samples of butter are taken at frequent irregular intervals from every distributor in accordance with methods which are reliable and fair. It is scored for commercial quality, tested for composition, and its packages examined for labeling. Sources of undergrade butter are made the object of special effort in the improvement of materials from which, and the methods by which, it is manufactured. Special permits are required for the manufacture of butter by the so-called "double churning" process, which makes it possible to manufacture butter from sour cream without the use of neutralizer. Permits also are required for the use of butter in the manufacture of ice cream. In San Francisco and Los Angeles butter is scored according to the United States commercial standards.

The quality of butter manufactured in California has been very favorably influenced through the milk and cream grading projects by improving the quality of the raw supply. The amount of sweet cream butter manufactured has been considerably in excess of that produced in former years.

4. CHEESE CONTROL

Thirty-nine varieties of cheese are manufactured in this state. Samples of each variety regularly are examined for quality and labeling, and are analyzed to determine the composition. Special permits are required for the manufacture of all varieties of cheese, for which definitions and/or standards do not appear in the dairy laws. Special effort is directed to the improvement of conditions at the place in which any low grade cheese originates.

5. ICE CREAM CONTROL

In keeping with the rapid development of the ice cream industry in this state, the California legislature enacted new standards for the product which are considered to go far toward insuring to the public an ice cream of highly dependable quality, and also will protect the industry from trade abuses by those who would seek to gain thereby. A maximum bacterial standard of 150,000 bacteria per gram was established. An initial survey shows the majority of the ice cream sold in this state comes within that requirement. Where illegal bacterial counts are found they have been due in most cases to lack of sterilization of the equipment. A total food solids standard also has been established by regulation requiring 1.6 pounds of food solids per gallon. This eliminates the placing on the market of an ice cream of insufficient weight and body.

Two ice cream specialists have been appointed whose entire time is devoted to the enforcement of the ice cream control program, and who have been of real material assistance to the ice cream trade in the solution of their problems. Ice cream samples are collected at frequent intervals from each manufacturer and forwarded to the laboratory for complete bacterial and chemical analysis. The results of these examinations are used as a basis for the field activities.

There also has been a substantial increase in the manufacture of ice milk during 1927. There has been a tendency among ice milk manufacturers to take advantage of the public appreciation of ice cream through the adoption of misleading trade names for ice milk. It was found that ice milk was being sold under such designations as "Fairy Fluff," "Frozen Custard," "Frozen Pudding," Frozen Milk Whip," etc., names which evade the use of the term "Ice Milk" and enable the product to pass under false colors since from the appearance alone the public is not able to distinguish ice milk from ice cream, in spite of the fact that ice cream must contain at least 10 per cent milk fat whereas the ice milk standards require only 2.4 per cent milk fat. The ice milk provisions relating to standards and labeling, which require the sale of the product only under the label of "Ice Milk," are being enforced rigidly. All other terms or trade names specifically are prohibited.

6. GENERAL PRODUCTS INSPECTION SERVICE

Evaporated and condensed milk, powdered milk, pure milk fat, buttermilk, cultured milk, acidophilus milk, modified milk and skim milk are sampled and analyzed for composition. Necessary attention is given to the sanitary conditions under which they are produced, manufactured or kept, corrective efforts being applied when instances of violation are found.

The value of acidophilus milk as a corrective of certain nutritional ills has become recognized to the extent that protective legislation was indicated for that particular product. This was provided at the last session of the legislature, a license of $100 being required for the manufacture of this product, and the department authorized to establish regulations pertaining to its manufacture and distribution.

The need for control of modified milk also has been felt with the result that it now is provided that this product, which consists of fluid milk altered in composition to conform to special nutritional requirements, be sold only upon prescription of a regularly licensed physician, and that a license of $100 be paid before engaging in the business of manufacturing, preparing, selling, or dealing in modified milk.

7. IMITATIONS LICENSING SERVICE

The control of dairy product imitations necessitates more attention from this bureau as the importance of all dairy products as an indispensable food becomes more and more firmly fixed in the minds of the public, thereby making it attractive to those who would place an imitation on the market. The principal imitation dairy product requiring the supervision of this bureau is oleomargarine. Manufacturers, wholesalers, retailers, bakers and restauranteurs who handle the product are required to be licensed. The number of those dealing in oleomargarine in this state amounts to tens of thousands, each one of

whom must be checked in order to determine that all persons are under license and familiar with the requirements under which the product must be handled.

One of the new imitation products which has been developed within the past year is frozen imitation milk, a frozen product in which the milk fat has been substituted by vegetable fat. Another product is imitation powdered milk, from which the milk fat similarly has been removed and vegetable fat introduced.

8. COMMERCIAL TESTING SERVICE

The best commercial practices in vogue with milk plants and factories engaged in the receiving and processing of milk include the purchase of such milk or cream on the basis of the actual milk fat contained therein. Such a method involves absolute exactness in contrast to approximation with respect to the content of the high priced ingredient. Since the official method for determining the milk fat content is standardized in its application in order to insure reliable results the necessity for frequent and thorough checking of the practices in that connection is quite apparent. Slight and unintentional departures from the exact procedure may be responsible for heavy losses either to the seller or buyer. The bureau licenses and supervises through a system of examinations and check testing all official testers, of which there are five hundred and fifty at present. Since so much depends upon accurate testing it is doubly important that the samples used for testing also be representative. All samplers and weighers therefore, are licensed and checked under a similar control program. Many thousands of dollars are saved to the industry each year through this method of control.

The need for a reliable check on the results of chemical examinations for milk fat where payment is made to the farmer on that basis has long been recognized. Recently a practice of also paying on the basis of the bacterial content of milk has been adopted by many plants. This practice has furnished an additional financial incentive to the dairyman to produce a milk of high quality. Since, however, bacteriology is much less exact in its application than chemistry there is greater opportunity for variations to occur in the results of bacterial analyses and even a greater need is manifest for a check being maintained on bacterial analyses than there is for a check on the Babcock test. Provision has been made for licensing by this bureau of all technicians conducting bacterial analyses of milk where the product is purchased on that basis. The license fee is $5 per year. Licenses are issued only after the applicant has successfully demonstrated his ability as a result of an examination. A check on the work of the technician is subsequently made at frequent intervals throughout the year.

9. DAIRY CONTAINERS EXCHANGE SERVICE

The nature of dairy products and the methods of transporting and distributing them make it necessary to handle them in containers which are so expensive that they must be used over and over again. In the complicated system of shipping and distributing these commodities there is an inevitable mixing of the property of different organizations, making it necessary that some means be provided for restoring the

containers which are misdirected in trade channels back to their proper owners. An amendment to the General Dairy Law of California provides for the registration of containers brands with the Department of Agriculture at a fee of $5 for each brand registered. The law makes it obligatory on the part of persons receiving containers bearing such registered brands to return them to the lawful owner. A containers investigator has been appointed, whose entire time is devoted to enforcing these provisions of the law. The value to the industry of protection offered in this manner has become very definitely recognized as indicated in a letter received from one plant manager in this state, who stated as follows: "The need for such efficacious measure has been felt keenly, and before its advent we bought one carload of bottles every month, but now it has been three months since we bought bottles for the dairy."

10. DAIRY STATISTICAL SERVICE

Beginning with 1927 dairy statistics are being compiled as a part of the Federal-State Market News and Grading Service. The information compiled and disseminated has to do with the value of production, manufacture and distribution of the various dairy products interstate movements, average cow production, average per capita consumption, and utilization and trends. These data offer a valuable guide to those who are interested in the development of a well balanced agricultural program in this state.

Our statistical reports have been compiled on a yearly basis in the past. However, it is proposed, beginning with January 1, 1928, to compile these reports on a quarterly basis which will furnish somewhat more immediate information on the subject.

A preliminary review of the statistical data gathered on dairying for 1927 indicates a slight increase in fat production for the entire state. The mountain counties continue to show a slight decrease in production while slight increases are shown in the Sacramento Valley, northern San Joaquin Valley and northern bay counties. Considerable increase is shown in the southern San Joaquin Valley and southern bay counties. Large increases are shown in the Los Angeles and San Diego sections. Other portions of the state indicate no change.

A comparison of seventeen butter manufacturing counties shows slight increases in Humboldt, Siskiyou, Glenn, Sacramento, San Joaquin, Sonoma, Tulare, Fresno and San Luis Obispo counties. Large increases are shown in Kings County. Decreases are reported from San Francisco, Stanislaus, Del Norte, Imperial, Merced and Solano counties, with no appreciable change in Marin County.

A comparison made in cheese manufacture shows a small increase over 1926, amounting to about 3 per cent.

The manufacture of condensed and evaporated milk shows an increase of about 33 per cent over 1926.

Market milk consumption shows an increase in practically all parts of the state, with the chief increases occurring at points of increasing population.

There is an impression among some students of the dairy situation that the further expansion of dairying in California should be limited to the extent of supplying the needs of California in order that we

may continue to enjoy the advantages of an importing state in contradistinction to the disadvantages of being placed on an exporting basis, which is the difference between offering the product on a seller's market rather than on a buyer's market. A broader outlook on dairying has been manifested showing the wisdom of considering the dairy expansion program from the standpoint of the supply and demand of the work at large rather than the limited consideration of the single state or group of states. At the present rate of expansion in dairy production in California there is still room for considerable development in order to supply the needs of this state, owing to the rapid increase in population and the marked increase in the per capita consumption of market milk and other dairy products which has been demonstrated to follow in the wake of improved quality, and education on the subject of the importance of dairy products as our most important food. Serious consideration may well be given to increasing the production of California dairy herds through selective breeding, scientific feeding and the conducting of individual cow production tests, by which means it is possible to identify the profitable from the unprofitable cow.

THE GRADING OF MILK AND CREAM FOR MANUFACTURING PURPOSES

By Frank H. McCampbell, Supervisor, Cooperative Federal-State Market News and Grading Service, Dairy and Poultry Products.

THE manufacturer of dairy products, like the manufacturer of other necessities, caters to the desires of his customers. If they demand an article of superior quality which he is not able or does not choose to produce, the business eventually will go to the firms which can and do meet this consumer demand. This clearly has been illustrated by the automobile industry. Due to a higher standard of living, the American people gradually began to desire more efficient and better looking automobiles. One large manufacturer was slow in awakening to this demand, but finally put on the market a greatly improved automobile, stating in his opening announcement that it was the customer demand that prompted his organization to produce a better car. In other words, the change in customer demand changed the quality of the product manufactured.

The dairy industry for a number of years has experienced a demand for an improved quality of manufactured products and only those manufacturers who are looking for and recognize the change in consumer demand will be able so to adjust their methods as to produce dairy products that really satisfy the public.

The improved quality of manufactured dairy products has increased consumer demand and has resulted in the necessity of a superior grade of raw products. Take, for instance, butter which a few years ago contained high acid flavors, either naturally or by the addition of starter. Gradually there was a change in the consumer's desires, so that at present millions of pounds of sweet cream butter are being turned out from coast to coast, and large distributors tell us that they have difficulty in filling their orders for this kind of butter.

Another illustration of the change in consumer demand is in the cottage cheese business. Formerly all cottage cheese was of the high

acid type, while last year millions of pounds were manufactured from sweet milk by precipitating the curd with rennet, giving a low acid curd.

Again we have the change in demand shown in the outlet for powdered milk for baking and cooking purposes, and also for poultry and stock feed. One concern alone in California is turning out as poultry feed hundreds of tons of powdered buttermilk which a few years ago went into the sewer.

Perhaps the greatest change of all has been in the quality of manufactured dairy products. National and state dairy councils, as well as health authorities, all over the country have focused the consumer's attention on the food value of good quality dairy products. The federal and state departments of agriculture also have had a great influence in stimulating a larger demand for high quality products.



FIG. 162. Grading cream for flavors and odors.

The problem of quality in manufactured dairy products is, after all, largely a production problem, and is recognized as such in practically all of the important dairy sections of the United States. The problem of manufacturing high quality dairy products is therefore one of obtaining high quality raw materials. In other words, first grade milk and cream are necessary if first grade butter, cheese, condensed milk and other manufactured dairy products are to be produced. Just as the manufacturer of furniture knows that he is unable to make mahogany tables out of soft pine, so the manufacturer of butter is beginning to realize that he can not produce 93 score butter from stale, rancid cream which is far on its way towards decomposition.

The cream grading problem is receiving special attention in Minnesota, Iowa, Indiana, California, Nevada and Washington. However, the method of procedure in the several states is quite different. The demand for better quality of raw products came, in every instance, from the industry itself. Butter manufacturers for the last twenty years have talked about the benefits of cream grading, but nothing much was accomplished, due to lack of uniform grades, enforcement of standards, and competitive conditions. However, it has been realized at last that early methods of cream grading failed because the consumer did not appreciate quality. The demand for quality has developed

to such an extent that the industry, especially the manufacturing section, is recommending legislation designed to enforce the grading of cream and milk for manufacturing purposes. As a step in this direction many groups of manufacturers have signed agreements to grade cream and milk on certain definite standards and grades. This demand for an improved raw product is a direct reflection of the demand exerted by the ultimate consumer for the best that is obtainable in the way of butter, ice cream, condensed and evaporated milk, cheese, powdered milk and other manufactured dairy products and by-products.



FIG. 163. Taking samples of cream for acidity test.

In the state of Washington, the Creamery Operators' Association backed a movement for the grading of cream. Representatives of the transportation companies and the State Department of Agriculture were called in. The result was that cream and milk grading came under the regulation of the State Department of Agriculture on June 10, 1927, which provides for the grading of all milk and cream purchased by licensed graders. Official state milk and cream grades were established which the Department could revise from time to time as the need arose. This plan has proved very satisfactory, and the manufacturers of dairy products in Washington say they would not go back to the old system of accepting any cream offered for sale regardless of quality.

The grading of manufacturing milk and cream in California is carried on by both the Federal and State Departments of Agriculture under a cooperative agreement entered into on July 1, 1927. The grading work done at country receiving points is tied up with the grading of the finished product at the large wholesale markets.

In California the cream for butter making is divided into four grades: first, second, third, and that unfit for human consumption. The grades on which the grading plan has been developed so far are as follows:

First grade cream should produce butter scoring 92 and above. It should be smooth and clean; free from objectionable flavors and odors; should be sweet or contain not more than 0.3 per cent lactic acid and should contain at least 30 per cent milk fat.

Second grade cream should produce butter scoring 90 to 91¼. It is somewhat fermented, has some objectionable flavors and odors, and contains in excess of 0.3 per cent lactic acid, but less than 0.6 per cent.

Third grade cream should produce butter scoring 88 to 89½. It may have distinct, objectionable, old and off flavors, may be foamy and curdy, and contain in excess of 0.6 per cent lactic acid.

Cream unfit for human consumption (rejected cream) has a very strong, stale flavor; is rancid, dirty and moldy; contains numerous flies, other insects, or vermin, or is in an advanced stage of fermentation or putrefaction, or otherwise unwholesome.

Efforts in grading cream at first were based largely on the acidity test, as the development of acidity in cream is a direct measure of the progress of decomposition. Ways and means are being considered of tying in with the acid test some standards for flavors and odors to be detected by taste and smell. One of our problems in California is flavors caused by improper feeding.

The acidity test is carried on by using a standardized alkaline solution so that a given amount of the solution will neutralize exactly 0.3 per cent acid in an equal amount of cream. Phenolphthalein is used as an indicator, and when equal amounts of the alkaline solution and cream result in a permanent pink color the cream contains less than 0.3 per cent acid and is put in first grade. If the color fades out the cream contains in excess of 0.3 per cent acid and is subjected to another measure of the alkaline solution. Should the color now remain pink the cream contains less than 0.6 per cent acid and is put into second grade. If the color again fades out the cream contains in excess of 0.6 per cent acid and is third grade. The equipment used in the acidity test consists of a bottle of alkaline solution, two dippers, one for the solution and one for cream, and a white cup.



FIG. 164. Plating samples of milk for direct microscopic count.

The following results were obtained in the southern part of the San Joaquin Valley, involving an area approximately seventy-five miles long and fifty miles wide, served by twelve plants receiving cream and five receiving milk, and having approximately four thousand cows. The test was conducted at the twelve plants between the latter part of May and the middle of July. The usual mean

temperature in this territory at the time the work was begun was around 90 degrees F. and ranged from 105 to 110 degrees F. during the latter part of the period, indicating that the results were secured in the face of increasingly hot weather. Part of the cream was delivered once daily, and a somewhat smaller proportion twice daily during the period.

Our object was the elimination of third grade cream and an examination of the results showed that our efforts were successful. The number of patrons from which first grade cream was received was increased from 45 to 60 per cent; the number furnishing second grade was increased from 25 to 36 per cent; and the number from which third grade cream was received was *decreased* from 30 to 4 per cent. The results from some of the individual creameries are even more striking, but no doubt you are interested in our net results.



Fig. 165. Making direct microscopic count.

The results in the Imperial Valley were even more satisfactory than in the San Joaquin Valley as temperatures were considerably higher. The test was conducted at the four creameries in the Imperial Valley from May to August, inclusive. The temperature during this period varied but little, averaging 100 degrees F. It is interesting to note that the territory in the Imperial Valley is from fifty to two hundred feet below sea level and water can not be used for cooling cream on the farm as the temperature is often as high as the freshly drawn milk. Cooling is accomplished by placing wet gunny sacks or canvas around the cans. While most of the cream is delivered once daily, in some cases delivery is made every two days. Despite this the two-day old cream often is still sweet upon delivery, showing the exacting care and sanitation practiced.

The third grade cream was entirely eliminated at the close of the period. The number of patrons from which first grade cream was received was increased from 26 to 49 per cent. The number of patrons from which second grade cream was received was decreased from 67 to 51 per cent, and the number of patrons from which third grade cream was received was decreased from 7 per cent to 0.

The results in Siskiyou County were also satisfactory. This territory is composed of mountain valleys of considerable altitude, and although the temperature in the summer is high it is not so high as in the other territories mentioned. While the results were not so dramatic as those obtained in the San Joaquin and Imperial valleys, the percentage of

patrons delivering first grade cream in May was increased from 45 to 70 per cent by October. The number of patrons delivering second grade cream was decreased from 42 to 24 per cent. The number delivering third grade cream was decreased from 16 to 5 per cent from May to October. Here again we have positive results accomplished during the season of rising temperature. By cutting down the vat



FIG. 166. Instructing dairymen how to properly handle utensils. The probable source of the bacteria in cream can be detected by the inspector from the microscopical examination.

acidity as a direct result of the cream grading work, the percentage of overrun was decreased, while the percentage of top grades of butter was considerably increased.

In the matter of paying the producer according to the grade of his cream, we have not progressed beyond suggesting such a plan to the plant managers. Quite a few creameries are making a reduction for third grade cream, as much as 10 cents below first grade in some instances. In the near future we hope to recommend a definite plan for the payment of manufacturing cream, based on the prevailing prices of butter at wholesale markets. We are tying up our wholesale grading at Los Angeles, San Francisco and Sacramento with the milk and cream grading at country points, and in this way expect the results eventually to carry through to the consumer.

Manufacturing milk grading in California by the simplified Breed direct count microscopic method, which combines into one operation and one solution the fat extraction fixation and staining, has brought instantaneous and positive results. The direct count method was begun about two years ago in California as an adjunct to platform inspection

and was adopted as the official method for grading manufacturing milk after a thorough investigation and comparison with other methods. These included the reductase (methylene blue), alcohol, acidity and sediment tests. The direct count method proved to be more accurate and consistent, as well as simpler and cheaper, and also gives more information than any of the other methods. However, the original Breed method proved too slow for commercial platform inspection, so in order to speed up the process, five smears were placed on a slide instead of one. A rack was designed to hold twelve slides with staining trays sufficiently large to accommodate them which made it possible to prepare samples from sixty different patrons at one time. The next effort was to hasten the individual steps in preparing the slides for observation. This ordinarily consisted of making the smear, drying it, extracting the fat, fixing the smear to the slide, staining the film,

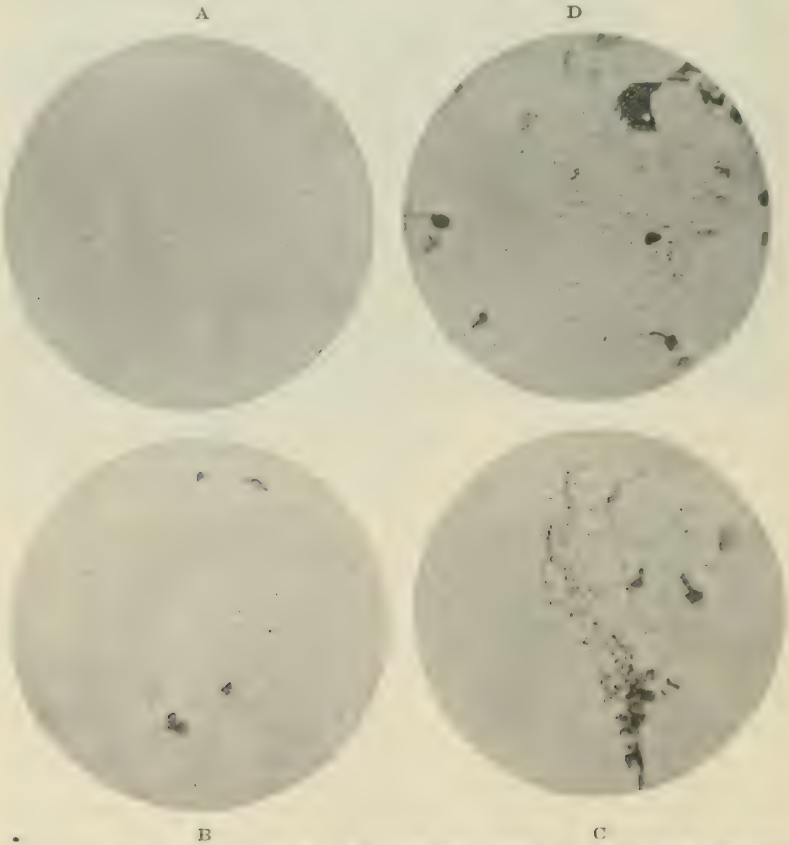


FIG. 167. What the inspector sees through the microscope is shown by the black spots on these discs.

A. Practically no bacteria present, First Grade.
B. Several bacteria, a few leucorytes, Second Grade.
C. Contamination from partly cleaned utensils and lack of sterilization, Third Grade.
D. Contamination from dirty cows, careless milkers and dust in barn, Third Grade.

decolorizing the background, washing, and again drying. In order to accommodate five smears, the slides were marked by sand blast with five separate cubic centimeter squares. The time of drying also was hastened by placing the slides on a thin flat metal plate over an electric light bulb which furnished the necessary heat.

The most important factor in shortening the whole method was the discovery of a new process for the preparation of the slides. This process combines into one solution the extraction of the fat, the fixing of the smear, the staining of the field and the decolorization of the background. Also it gives a less destructible film and a sharper contrast between the bacteria and the background. In addition it is less expensive and reduces the equipment carried by the grader, an important item in field operation. The modified Breed direct count method has reduced the time of dairy inspection from hours to minutes, and focuses the attention of the grader on the dairies which need it most. Under the old method of dairy inspection a man making ten calls a day required a whole month to visit 250 producers. Even then he was not able to observe the methods practiced at each dairy. With the direct count method in two days a man is able to sample the milk from 250 patrons, count all the slides, and place each patron's milk in the proper grade. He then has the rest of the month to follow up the dairies which have delivered high count milk. Under the new system of dairy inspection one man can grade several plants efficiently and can handle a much larger territory than under the former system.

An example of the results which can be obtained is shown by a demonstration in which milk from approximately one thousand dairies, delivered to eight plants manufacturing dairy products, was used. These plants served an entire competitive area and included both cooperative associations and independent concerns. The types of business included sweet cream stations, ice cream mix plants, cheese factories, creameries, condensaries, and by-product plants. Within a short time the quality was improved from a condition bordering on condemnation to a point where all the milk could have been mixed together, pasteurized, and sold as Grade A market milk. Such results had not been considered possible, although the several plants had spent considerable money in quality improvement. The following table shows the results:

	1st count	*2d count*	*3d count*
Patrons delivering 1st grade milk	20%	35%	45%
Patrons delivering 2d grade milk	47%	27%	26%
Patrons delivering 3d grade milk	57%	26%	17%

These results were obtained in two weeks of intensive work, and under ordinary circumstances would be fully satisfactory if obtained in two months time. The grades of milk represented in the above table are as follows:

First grade milk, which contains 1,000,000 or less bacteria per cubic centimeter by direct count method, or about 200,000 standard plate count, corresponding roughly to the requirements of Grade A milk for pasteurization.

Second grade milk, which contains between 1,000,000 and 5,000,000 bacteria per cubic centimeter by the direct count method, or between

200,000 and 1,000,000 standard plate count, corresponding roughly to the requirements of unpasteurized Grade B milk.

Third grade milk, which contains more than 5,000,000 bacteria per cubic centimeter by the direct count method.

The direct count method shows about five times as many bacteria as the standard plate method when milk has upwards of 200,000 by the standard plate count. This ratio no doubt would be less in milk having fewer bacteria.

The improvement in milk quality was shown by the movement of dairies from second and third grades into first. Dairies remaining in the lower grades at the end of the period were in most instances small ones, and a tabulation of results based on the volume of milk would show even more favorable results.

The plants involved in this grading work have proved to their own satisfaction that it is more profitable to handle an improved raw product. Evaporated milk plants obtained a better flavored milk, and had fewer swelled cans. Cheese factories reported less loss from gassy cheese, and all plants reported a higher quality finished product with less loss. One plant, because of the improved quality, was able to hold its product over for a longer period and thereby lay off one eight-hour crew, reducing the pay roll several hundred dollars a month. Another plant which paid whole sweet milk prices for milk to be used in some of the higher priced commodities, previously had been forced to skim that which was of poor quality and sell the cream at a loss. This loss for one week was sufficient to pay the cost of the grading work for that plant for one year.

The improvement in the dairies was accomplished mainly by the efficient use of sterilizers for the equipment used in handling milk, and discarding rag strainers. These two things have not added appreciably to the dairyman's cost of production, proving conclusively that the production of high quality milk is neither costly nor burdensome. Those plants which undertook the grading work in 1925 have been so well pleased with results that they have voluntarily doubled the amount of money expended in the cooperative agreement so that two men could spend their entire time on improvement work and gradings could be made more frequently.

The milk and cream grading work has shown such beneficial results under very adverse conditions in widely separated districts that we have no hesitancy in recommending it to other states. It has been so attractive to creameries, milk plants, condensaries and cheese factories in California that at present we have four milk and cream grading projects in which the cost of grading by federal-state graders is paid entirely by the plants on a pro rata milk fat basis, the actual cost ranging from one-fifth of a cent to two twenty-fifths of a cent per pound of milk fat.

DIVISION OF ANIMAL INDUSTRY

DR. J. P. IVERSON, Chief.

IN SUMMING up the live stock situation in California for 1927, we note with considerable satisfaction that conditions in general were more favorable than for a number of years past. The valuation of beef cattle, dairy cows, and sheep showed a marked increase. The most noticeable improvement was in the range cattle business, which now is recovering from the economic depression which prevailed for some time. Satisfactory conditions for the sheep raiser continued with good prices and a large crop of wool and lambs. Fortunately, also, no unusual or serious outbreaks of infectious diseases occurred to exact any abnormal toll.

The various functions of the Division of Animal Industry serve in a large measure to make the live stock business more profitable. Efforts directed toward control, eradication, and prevention of outbreaks of communicable diseases and the enforcement of regulatory measures are important factors in the conservation of the live stock of the state. Maintaining animals in a healthy condition and providing proper sanitation in producing and handling animal products for human consumption are also of great importance to public health.

Almost every section of California is adapted to the raising of live stock and this branch of our agriculture should appeal to those interested in animal husbandry. Diversified farming, including the raising of livestock, now is receiving more attention than formerly. Encouragement now is being given quite generally to the idea of supplementing every type of farming with live stock.

INFECTIOUS DISEASE CONTROL

An important service rendered by the Division of Animal Industry is the prevention, suppression and elimination of communicable diseases affecting animals. Success is dependent upon healthy live stock and therefore prevention should be given first consideration. The division endeavors to advise owners regarding sanitation and other precautionary measures in the prevention of disease.

Enforcement of quarantine, application of preventive measures, cremation or deep burial of animals, preferably with lime, and appropriate disinfection must be carried out promptly to limit the spread of infectious diseases when they occur. Along with other duties the field veterinarians constantly are making inspections of all classes of live stock in order to detect as early as possible the presence of disease and prevent unnecessary losses.

SHEEP SCAB

An accomplishment of the past couple of years is the near eradication of sheep scab. Careful quarantines and effective dipping of infested flocks almost have banished this disease from the state. Only a few flocks affected with scab were found in 1927, one of which was a band that broke after coming in from another state. Few counties remain under the federal quarantine originally put on the state many years

ago when sheep scab was prevalent. It is hoped that every county soon will be released so that California can be placed in the list of states free from the disease.

California is classed as one of the finest sheep raising states in the country, as favorable climatic conditions and an abundance of rich green feed during the winter months make possible the finishing of the earliest lambs for the market. Texas is now the only state outranking California in the estimated number of sheep, but owing to a higher value per head here, the total value of all sheep on farms and ranges in California is more than $1,000,000 greater than in Texas. The total number of sheep on California farms at the end of 1927 has been estimated by the Cooperative Crop Reporting Service at 3,528,000, with a total value of $40,014,000.

HOG CHOLERA

There was no unusual prevalency of this disease during 1927.

A number of ailments of hogs frequently are mistaken for hog cholera. A common condition met with which produces confusing symptoms is a feeding trouble brought about by a too rapid change to large amounts of feed to which their digestive systems are not accustomed. The disturbance causes an increased permeability of the intestinal mucous membrane, permitting the normal intestinal organisms to pass through and enter the body circulation and thereby become pathogenic. This condition is known under various names as paratyphoid, necrotic enteritis and sometimes is called hemorrhagic septicemia. The treatment consists of corrective dietetic measures. The indiscriminate use of serum and virus in these cases should be discouraged because generally it will be followed by disastrous results.

Infestation by intestinal worms, particularly the *ascaris lumbricoides* and other parasites, leads to unthriftiness in hogs and causes great losses to the swine raiser.

GLANDERS

This year, according to the records, there was quite an increase of glanders cases, as 149 affected animals were found. Most of this number were horses and mules belonging to one large concern. Only a few were clinical cases and the others were contacts which reacted to the mallein test. None of the contact cases showed lesions, indicating that the spread from that focus of infection was detected early. All affected animals were destroyed and deeply buried, and all places and objects likely to be contaminated were disinfected.

REPORTS OF COMMUNICABLE DISEASES

A provision of the law requires that communicable diseases be reported to this Department, but apparently this is not observed always as carefully as it might be. The following table shows the reports of diseases, listed by counties, which were received by this office during 1927; obviously it is incomplete.

TABLE 4—DISEASES REPORTED BY COUNTIES DURING 1927

	Abortion	Anthrax	Blackleg	Glanders	Hog Cholera	Rabies	Diseases—Cattle	Diseases—Goats	Diseases—Hogs	Diseases—Horses	Diseases—Poultry	Diseases—Sheep	Total
Butte		7			21		1	1	1				31
Calaveras					1		3		1			1	6
Colusa		3			1		3				1	1	9
Contra Costa					1		3					1	5
Del Norte	1												1
El Dorado								1					1
Fresno		1					1						2
Glenn		1					3		1		1		6
Humboldt												1	1
Imperial				1			3			3		1	8
Inyo										2			2
Kern		1										1	2
Kings					1								1
Lake	1						1			2		1	5
Lassen					1		2		1				4
Los Angeles				1			4		1			1	7
Madera							2						2
Marin		2			1	11							14
Mariposa									1				1
Mendocino					1		2		2			7	12
Merced		2		4	1		5		1				13
Modoc							1						1
Monterey					1		4						5
Napa									1		1		2
Nevada							1						1
Orange							1						1
Placer							1		1			1	3
Plumas					2		1						3
Riverside					1					1		1	3
Sacramento	1			1	1			1	2		1	1	8
San Benito							1					1	2
San Bernardino						2							2
San Diego					2	1	1						4
San Joaquin		3		2	3		5		1			7	21
San Luis Obispo				1	1				1	1			4
San Mateo								1					1
Santa Barbara					2		1		1				4
Santa Clara	1	1							1				3
Shasta							2		1			2	5
Siskiyou							1		1				2
Solano				1			1					2	4
Sonoma		1					4					11	16
Stanislaus		1	4		6		5		3			1	20
Tehama			1		2		1		5	2			11
Tulare					1		1		1				3
Tuolumne					1		1						2
Ventura					1								1
Yolo							1		1				2
Totals	4	23	5	11	53	14	67	4	29	11	4	42	267

LIVE STOCK IMPORTATIONS AND QUARANTINE SERVICE

The control of animal diseases within our borders would be of little avail if we did not guard against the introduction of diseases from the outside. The enforcement of laws and regulations governing importations is therefore an important service. This state is free from a number of dangerous animal diseases which, were it not for this supervision might gain entrance at any time. The position of California, facing the Orient and bordering on a foreign country, makes this danger imminent. Considerable disaster would be brought about if diseases such as rinderpest, foot and mouth disease, European fowl plague, Texas fever, and cattle scab should gain entrance and be permitted to spread. Most animals must be accompanied by inspection certificates at the time of importation and in many cases they are kept

under observation for some time after arrival. As a further precautionary measure the division maintains inspectors at a number of public stock yards and other points of animal concentration who continuously keep a close watch over shipments of live stock and poultry reaching this state. A summary of this work is given in the following tabulations:

TABLE 5—INTERSTATE SHIPMENTS SHOWING STATES OF ORIGIN, YEAR OF 1927

	Dairy Cattle	Horses	Mules	Feeder Sheep	Rams	Other Classes Sheep	Total
Arizona	1,262	15	44	71,797		2,060	75,178
Canada		22			3	4	29
Colorado	1,777	151	6				1,934
Connecticut	2	1					3
Idaho	4,824	420	7	10,794	1	514	16,560
Illinois	31	19					50
Iowa	41	17	2				60
Kansas	14	4	134				152
Kentucky		20				2	22
Maine	1						1
Michigan	40						40
Minnesota	190						190
Mississippi	1						1
Missouri	110	52					162
Montana	367	133			160		660
Nebraska	11	10					21
Nevada	907	93		108,239	396	850	110,485
New Jersey	49						49
New Mexico	41	38		750			829
New York	8						8
North Dakota		2					2
Ohio	29				3		32
Oregon	5,177	74	20	63,387	621	1,495	70,774
Oklahoma					1		1
Pennsylvania	3						3
Tennessee	1						1
Texas	1,140	26	8	19,350			20,524
Utah	3,070	460	108	19,666	427		23,731
Washington	960	3			1	996	1,960
Wisconsin	886	1			1		888
Wyoming	105	122					227
Totals	21,047	1,683	329	293,983	1,614	5,921	324,577

TABLE 6—INTERSTATE SHIPMENTS SHOWING COUNTIES OF DESTINATION, YEAR OF 1927

	Dairy Cattle	Horses	Mules	Feeder Sheep	Rams	Other Classes Sheep	Total
Alameda	174	46		6,858			7,078
Alpine	104						104
Butte				3,030	16		3,046
Calaveras						50	50
Colusa	5			3,600			3,605
Contra Costa	84				50		134
Del Norte	15						15
El Dorado	23				22		45
Fresno	1,079	28		16,607	172	20	17,906
Glenn	88					963	1,051
Humboldt	1				43	24	68
Imperial	180			46,949			47,129
Inyo	100				26		126
Kern	91			4,100			4,191
Kings	136			8,200			8,336
Lassen	17	30		34,325	152	4	34,528
Los Angeles	14,669	959	163	11,198		1,209	28,198
Madera	133				49		182
Marin	34						34
Mendocino					2		2
Merced	103	21		8,098	33		8,255
Modoc	23			22,200	329		22,552
Mono	44						44
Monterey		32					32
Napa	40						40
Nevada	25			2,500	43		2,568
Orange	204	21					225
Placer	70	2		1,760	53		1,885
Plumas	97	2	2		84		185
Riverside	107	66	22				195
Sacramento	23	34		2,250		1	2,308
San Benito		17					17
San Bernardino	998	7	44		1		1,050
San Diego	62	38	8	6,092			6,200
San Francisco	2	4		870	156	2	1,034
San Joaquin	100	120	90	56,134	160	17	56,621
San Luis Obispo	309	30			1		340
San Mateo	2	30					32
Santa Barbara	214	31		1,016			1,261
Santa Clara	1	58					59
Santa Cruz	1						1
Shasta	4	5		1,200			1,209
Sierra				9,100			9,100
Siskiyou	872					1,140	2,012
Solano	35	2			4		41
Sonoma	38	70			3	248	359
Stanislaus	320	22		5,664	50		6,056
Sutter				2,032	5		2,037
Tehama	87			2,900	11	411	3,409
Tulare	148	1				860	1,009
Ventura	27	3		3,285			3,315
Yolo	104	4		21,544	148	172	21,972
Yuba				12,471	1	800	13,272
Unknown	54						54
Totals	21,047	1,683	329	293,983	1,614	5,921	324,577

TABLE 7—MISCELLANEOUS LIVE STOCK INSPECTIONS AT CENTRALIZATION POINTS DURING 1927

	Cattle	Sheep	Swine	Goats	Horses, Mules	Total
January	88,630	104,953	64,912	161	205	258,861
February	53,269	83,971	60,898	659	267	199,064
March	50,437	68,256	60,993	781	76	180,543
April	39,391	68,174	47,768	200	88	155,621
May	51,408	102,561	60,139	37	117	214,352
June	56,212	95,412	47,573		58	199,255
July	31,996	82,732	24,289	22	24	139,063
August	14,189	48,174	9,021			71,384
September	131,322	136,298	38,370		44	306,034
October	104,417	201,349	50,936		213	356,915
November	91,369	128,029	58,046	3		277,447
December	93,148	188,841	53,933			335,922
Totals	805,878	1,308,750	576,878	1,863	1,092	2,694,461

TABLE 8—CARS OF POULTRY SHIPPED INTO CALIFORNIA FROM EASTERN POINTS DURING YEAR OF 1927

	Colorado	Idaho	Illinois	Indiana	Iowa	Kansas	Minnesota	Missouri	Nebraska	New Mexico	Oklahoma	South Dakota	Texas	Utah	Washington	Total
January	5					4½		5	25½		5		9			54
February	5½					2		2	19½		3		10			42
March								3	14	1	6		24			48
April						2		2	15	4	6	1	15			45
May	1					1		3	18	1	3	1	9			37
June					1			7	13		1	1	9	5		37
July		3				1		5	16		1			2		28
August		1		1				3	5							10
September	3	2				1		3	18							27
October	7½	2						3	20½		2		2		4	41
November	3	12	1		2	2	1	11	59	1	2		2		2	98
December	5	4	1			1		8	37		1		2			59
Totals	30	24	2	1	3	14½	1	55	260½	7	30	3	82	7	6	526

FEDERAL COOPERATION

The division gratefully wishes to acknowledge the cooperation of the United States Bureau of Animal Industry. Valuable service has been rendered in the control of sheep scab, tuberculosis, hog cholera and other diseases by the Federal Department under the direction of Dr. Rudolph Snyder, in charge in this state. The success in disease eradication and progress in tuberculosis control which has been attained would not have been possible to so great an extent without this cooperation.

ASSISTANCE RENDERED DAIRY AND MEAT INSPECTION

The veterinarians employed by this Division in regular field service often devote considerable time to inspections of dairies and slaughterhouses, and frequently are called upon to relieve meat inspectors. The assistance thus rendered in the enforcement of the California Dairy and Meat Inspection laws serves to expedite and increase the efficiency in these endeavors.

LABORATORY SERVICE

The pathology laboratory is a valuable asset in animal disease control work since it can be called upon to definitely diagnose, by means of scientific tests, many conditions which can not be determined in the field. That the service is appreciated is manifested by the constantly increasing number of specimens submitted for examination. The important activities of the laboratory worker are examination of specimens, making tuberculin, and special disease investigations. All of the tuberculin used in conducting official tuberculin tests by the field veterinarians is made in the laboratory. In accordance with a collaborative arrangement all chemical analyses are made by the laboratory of the chemistry division. The following table shows the examinations made during this year.

TABLE 9

Pathological examinations	107
Examinations for poisons	12
Examinations for parasites	23
Examinations of feeds	4
Weed identifications	5
Water and chemical analyses	4
Tuberculin distributed to field veterinarians	23,168 c.c.

POULTRY

What might be considered one of the new activities of this division is the attention given to diseases of poultry. The growth and size of the industry has made poultry ailments a subject of greater interest and importance and this office frequently is called upon to give assistance and advice to poultrymen who encounter trouble in their flocks. As mentioned under quarantine service, the inspection of incoming shipments of poultry is carried on as a precautionary measure against the possible introduction of outside diseases which seriously could affect the industry.

The exportation of baby chicks from California has assumed considerable magnitude. Several of the northwestern states adopted regulations requiring that all imported shipments of chicks must be certified to as free from *bacillary white diarrhea,* and these restrictions have made it necessary for the division to authorize a number of veterinarians and laboratories to conduct the required test of our flocks producing eggs for hatcheries.

During 1927, in cooperation with several other agencies, this Department established a poultry laboratory in southern California, the director of which is a veterinarian in the employ of this division. A large number of birds have been submitted for examination and many diseases diagnosed. Special investigations also have been carried on in many localities in that part of the state. This year the laboratory tested 75 flocks with a total of 17,593 birds for *bacillary white diarrhea.*

STALLION REGISTRATION

The licensing of stallions and jacks is carried on in accordance with the Stallion Registration Law. Before an animal can be licensed, it must be passed upon for soundness by a qualified veterinarian. The purpose of this service is to permit only sound stallions and jacks to be used in public service, in order that defects may not be transmitted. Valuable protection therefore is rendered the owners of breeding mares. The license fee is very nominal, and not unduly burdensome to those who desire to stand their stallions for public service.

The decrease in the number of horses and mules during the past years should make a greater demand for good draft animals in the future. Special Publication No. 77, issued June 30, 1927, gives information regarding all licensed stallions and jacks at that time in California.

BOVINE INFECTIOUS ABORTION

This disease also is known by various names as Bang bacillus disease, Bang abortion disease, Contagious abortion, and Brucella abortus. Probably no other animal disease has received so much study in recent years by scientific investigators. It manifests itself most seriously in cattle, although it occurs in all species of live stock and is a menace

to the cattle industry, causing a serious loss to farmers. Not only does it cause abortions and reduction of the calf crop, but also it decreases production in infected herds. Many of the infected animals become sterile and therefore are lost to their owners as producers.

No cure is known at present; however, the disease can be prevented. Certain tests have been devised by which the infection in animals may be detected. Therefore control of the disease is a possibility. Individual herds or even cattle in circumscribed areas can be made free of contagious abortion which greatly will benefit the owners, and also will provide a source from which others can obtain noninfected animals for additions or replacements.

TEXAS FEVER, CATTLE SCAB, ANTHRAX AND BLACK LEG

Perhaps the most gratifying achievement in animal disease control during 1927 was freedom from Texas fever or cattle scab in the state. By dint of hard work and energetic measures during former years, these pernicious cattle diseases were eradicated. It has taken constant vigilance to prevent their being brought in again since they still are widespread in many parts of this country and Mexico. The complete eradication of these maladies has been of inestimable value to the live stock industry and has meant a tremendous saving to California.

In the past year there were fewer cases of anthrax and black leg than formerly. No outbreak became very extensive. Live stock owners constantly are being advised regarding effective vaccination, quarantining, complete burning of carcasses, and disinfection.

BOVINE TUBERCULOSIS LAW*

The work of this division has been augmented considerably by a number of new duties and activities. The most important of these is the enforcement of the Bovine Tuberculosis Law, which was passed by the 1927 legislature, and became effective July 29. Besides the former statutes pertaining to tuberculosis control this act contains a number of important new provisions. The scope and purpose of the more significant new requirements are discussed in an article which appeared in the January, 1928, issue of the monthly bulletin.

The law aims to control the use of tuberculin by requiring that it be produced only in laboratories holding a federal license, and restricting its sale and use to veterinarians approved by this department. The reports submitted in accordance with requirements of this law show that the following amounts of tuberculin were sold for use in California during the period from July 29, 1927, to December 31, 1927:

Intradermic	Subcutaneous	Ophthalmic	Avian
8688 cc	1656 cc	4745 discs	56 cc

For a number of years this Division has maintained a laboratory for the production of tuberculin to be used officially in the control of tuberculosis. In order that it might be continued when this law became effective it was necessary to apply to the United States Department of Agriculture for a license. The laboratory has been moved into new quarters and every effort has been made to meet the new requirements. It is expected that the requested federal license will be granted in the near future.

*By Dr. H. P. Bonnikson, Senior Field Veterinary.

When the act became effective, approval to possess and use tuberculin was extended by this department to 501 veterinarians comprising all those holding a license to practice in California. For sufficient causes this privilege has been permanently revoked in one instance and suspension of the privileges granted several others has been found necessary.

In accordance with the provision that the results of all tuberculin tests must be reported, there were received from approved veterinarians during the past five months approximately 3500 reports. The tests thus reported by practitioners, made at the request of owners, show 43,183 animals tested, of which 3824 were reactors. These tests of course are exclusive of those officially conducted by the state and federal departments, and therefore constitute records which heretofore have not been available.

The provision of the law requiring the branding of reacting animals with the letter "T" on the left jaw for permanent identification has been carried out with less objection than perhaps was expected. In every instance but one, where objection was raised to branding, the requirement was observed when the purpose and intent of the law were fully explained. An exception to the branding requirement, effective until July 1, 1929, is permitted in the cases of registered purebreds where there are one or more purebred females in the herd. In accordance with this alternative only 10 reacting purebreds have been identified by submitting registration names and numbers and photographs of each side of each animal. The permanent identification of reactors is considered very important, since upon the proper handling and disposition of affected animals depends the ultimate success in control and eradication of tuberculosis.

It is the earnest desire of this Division to have the provisions of this law carried out with the cooperation of all concerned, but no hesitancy will be shown in filing complaints when attempts are made to evade it. Two prosecutions were found necessary under this act and in each instance convictions were secured. One of these dairymen was charged with interfering with the test and the other with refusing to brand reactors.

Attention has been given to that section of the Bovine Tuberculosis Law which requires that imported cattle must be held under supervision by the Department for 60 to 90 days after arrival. Purebreds must be retested and the reactors either branded or returned to place of origin. Grade dairy cattle, however, may be retested if it is deemed necessary. Another important provision requires that all cattle for exhibition purposes must be tested by a licensed veterinarian and found free from tuberculosis before they can be entered for exhibition at fairs or live stock shows.

TUBERCULIN TESTING PROVISIONS OF THE PURE MILK LAW*

Official tuberculin testing has been carried on since 1915 under this act, which requires that dairy products sold to be consumed raw must be produced by cows free from tuberculosis. Milk from nontested cows must be pasteurized. This act, while intended primarily as a public health measure, has made it possible for many owners in the

*By Dr. S. O'Toole, Superintendent of Tuberculosis Control.

state to develop and maintain herds free from tuberculosis. There seems to be a growing sentiment in a number of California cities favoring the production of their entire supply of milk from cows free of disease. Consequently, many new applications for tests have been received and the demand for this service constantly is increasing.

Following is a summary, by counties, of the tuberculin tests conducted under this law during the past year:

TABLE 1

Counties	Herds tested	Herds of 10 animals or less	Herds of 10 animals or less free	Herds of more than 10 animals	Herds of more than 10 animals free	Animals tested	Reactors
Alameda	146	124	117	22	10	1,469	87
Amador	73	55	53	18	16	577	12
Butte	413	331	287	82	46	2,529	157
Calaveras	26	22	18	4	2	142	4
Colusa	98	81	66	17	7	739	45
Contra Costa	120	96	92	24	14	1,118	50
Del Norte	40	17	17	23	14	1,134	33
El Dorado	93	73	71	20	13	1,258	18
Fresno	689	660	625	29	16	1,737	73
Glenn	127	94	83	33	20	1,114	50
Humboldt	433	335	299	98	53	3,890	229
Imperial	99	49	44	50	9	2,839	131
Inyo	51	34	31	17	12	1,250	22
Kern	166	91	87	75	50	3,504	96
Kings	40	27	24	13	5	827	71
Lake	142	111	100	31	23	801	19
Los Angeles	938	536	483	402	110	30,594	2,193
Madera	53	46	38	7	4	316	24
Marin	29	9	9	20	10	663	27
Mendocino	362	244	218	118	89	4,919	104
Merced	55	41	37	14	9	444	12
Mono	9	8	8	1	1	62	.....
Monterey	72	63	55	9	6	506	24
Napa	126	113	103	13	9	780	25
Nevada	76	52	50	24	20	664	8
Orange	462	373	333	89	22	5,238	501
Placer	158	131	127	27	18	1,145	57
Riverside	358	252	231	106	45	4,853	273
Sacramento	290	251	223	39	21	2,281	311
San Benito	81	72	65	9	2	551	29
San Bernardino	363	209	184	154	43	7,623	442
San Diego	724	469	460	255	192	12,182	166
San Francisco	1	1	.....	.....	.....	2	1
San Joaquin	168	123	113	45	15	2,557	71
San Luis Obispo	146	113	105	33	16	1,798	83
San Mateo	108	94	94	14	6	1,392	674
Santa Barbara	157	82	74	75	28	6,400	471
Santa Clara	396	314	299	82	31	3,941	325
Santa Cruz	316	272	266	44	35	2,167	30
Shasta	26	15	12	11	4	436	15
Sierra	16	7	7	9	8	289	1
Siskiyou	104	64	61	40	32	2,065	54
Solano	87	65	59	22	4	1,639	127
Sonoma	446	387	351	59	26	2,826	144
Stanislaus	179	148	138	31	12	1,507	66
Sutter	89	73	62	16	4	756	47
Tulare	311	255	240	56	23	2,366	109
Tuolumne	49	33	28	16	9	582	26
Ventura	164	125	114	39	11	3,427	145
Yolo	129	113	101	16	2	1,076	88
Yuba	32	24	21	8	4	383	12
Totals	9,836	7,377	6,783	2,459	1,181	133,358	7,782

AREA PLAN OF TUBERCULOSIS ERADICATION

Tuberculosis eradication under the area plan is carried on cooperatively by the state and federal departments. The law was passed in 1921 and now is incorporated in the Bovine Tuberculosis law. It permits counties with 90 per cent of their cattle free from tuberculosis

to undertake eradication before the disease becomes well established. Four counties have undertaken this work in northern California. The project has been carried on so satisfactorily in Tehama County that apparently it soon will be declared a modified accredited area, thus joining Modoc and Lassen which have had that distinction for some time. In September of this year Plumas was declared an eradication area and according to the progress being made, it should not be long until the percentage of tuberculous cattle in that county is reduced to one-half of 1 per cent, when it also can be designated a modified accredited area.

Shasta also has requested the benefits of the plan. A survey including tuberculin testing will start in January, 1928, and should the percentage of cattle found infected be less than 10 per cent the county will be declared an eradication area.

The area program is growing in favor as its benefits are being realized. Siskiyou, Nevada, and other counties are now giving it consideration. Ultimate eradication of the disease depends upon the area plan and it seems that other eligible counties should give the work serious consideration. The longer tuberculous cattle are permitted to remain in an area, the greater becomes the possibility of the spread of infection and consequently the more difficult its eradication. The tuberculosis free areas will be in a most favorable position in the future since owners throughout the state are being confronted more and more with the problem of obtaining tuberculosis free cattle to replace reactors removed from herds. The following tabulation gives the results of the tests conducted under the area plan of eradication.

TABLE 2—FREE AREA WORK, 1927

County	Number of animals Tested	Number of reactors	Number of herds
Lassen	8,007	38	229
Modoc	19,993	73	422
Plumas	14,627	172	260
Tehama	14,084	143	875
Totals	56,711	426	1,786

TUBERCULOSIS FREE ACCREDITED HERD PLAN

Owners of purebred or high grade herds can eliminate tuberculosis under the provisions of this plan which also is carried out jointly by the state and federal governments. An act authorizing this work was passed in 1921 and it is now a part of the Bovine Tuberculosis Law. A certificate of accreditation is issued when in accordance with prescribed requirements, a herd has become free of the disease. California can point with pride to the many valuable tuberculosis free herds which thus have been established. At the present time there are 104 herds fully accredited and 123 herds in the process of accreditation, comprising a total of 15,977 animals.

ANAPLASMOSIS OF CATTLE*

This disease has been observed for some time in the past, but not until recently did it become recognized sufficiently in this state to receive much attention. Formerly it was considered a form of Texas fever. Investigations carried on during the past year show that it is quite generally distributed throughout California. This disease occurs in a number of localities in the United States, especially in the southern states and it is found also in the Philippine Islands, South Africa and other places. Marked changes take place in the blood. The significant feature, microscopically, is the appearance of small bodies in the red cells. It is manifested in two forms—*Anaplasmosis Centrale* and *Anaplasmosis Marginale*. The former is of relatively low pathogenicity, while the latter usually manifests a somewhat higher mortality. *Anaplasmosis Marginale* is the one occurring in this state, and here for the first time it is found as a separate and distinct entity. Previously it was believed that the disease was carried or transmitted by ticks, but it has been definitely shown that in the absence of ticks the disease occurs in two areas in California. However, in these districts animals are attacked by large numbers of black and white horse flies, which may be a factor in the transmission of the malady.

Animals affected first show a loss of appetite, marked weakness, and in females milk secretion is interrupted. When the symptoms first are noticed, the temperature is high; later it drops and becomes irregular. Respiration and the pulse rates are both increased. The blood becomes anemic, which is quite characteristic, while the visible mucous membranes and the skin appear very jaundiced. There is a marked loss of flesh and the animals may remain recumbent for weeks. The ordinary period of recovery of those that survive extends over several months. No satisfactory vaccination or other treatment has been discovered.

OSTERTAGIA-OSTERTAGI

This disease of cattle was found this year for the first time in California. It is due to an infestation of the fourth stomach, or abomasum, by countless slender, yellowish white, hairlike worms, known as *Ostertagia-Ostertagi*. The worms invade the lining of the stomach, causing a marked thickening and folding of the mucous membrane. The diseased animals become weak, emaciated, anemic and diarrhea develops. The only treatment that has given any degree of satisfaction is drenching with a 1 per cent solution of copper-sulphate.

Ostertagia-Ostertagi has been observed by inspectors of this division in three counties, namely, San Joaquin, Tehama and Santa Barbara.

ICTERO-HEMOGLOBINURIA

This disease also is known as Mountain Disease. It is a disease of cattle occurring in the mountain districts around high mountain swamps, and at times causes considerable loss. This malady has been known and studied for a number of years, and while it is very difficult for investigators to work with, progress is being made. A vaccine has been prepared and is being used, and it is hoped that it will prove satisfactory in the control of this disease.

*By Dr. R. H. Mills, Senior Field Veterinarian.

PARASITIC DISEASES OF SHEEP*

One of the important activities of this division during the year has been the work carried on in connection with *stomach worm* and *liver fluke* infestations in sheep. Realizing the great ravages caused by these parasites, energetic steps were taken to institute methods of control. Parasitic infestation of sheep is a matter of serious concern to sheep raisers when it is realized that 90 per cent of all sheep ailments are caused by parasites. The lambs usually are attacked most severely. Unthriftiness is the paramount symptom of parasitic diseases. In many cases when sheep begin to show weakness and loss of condition it is advisable to give these parasites some consideration in order that treatment and control measures may be started before the infestation becomes extensive.

TABLE 3—INSPECTIONS AND DIPPINGS OF SHEEP FOR YEAR 1927

	Inspections	Dippings		
		Infected	Exposed	Free
January	90,371	10,760	7,350	
February	76,858	15,100	8,829	
March	387,682	915	50	
April	299,205	1,391	6,930	
May	150,509	411		
June	97,028		159	580
July	68,282		2,437	580
August	65,681	4,092	1	
September	142,278	1,935	6	
October	162,097	1,106		
November	188,133			
December	181,114	10		
Totals	1,909,238	35,720	25,762	1,160

Many reports of sheep ailments are received at this office necessitating a large number of investigations and sheep raisers are being advised constantly regarding the present accepted methods of control. Very satisfactory results have been obtained in handling sheep diseases caused by various internal parasites.

Liver flukes were quite generally widespread during the year and perhaps caused the most serious trouble. They inhabit swampy areas, pools and other places containing still, fresh water. Many remedies have been tried in the past, but not with entire satisfaction, though a product known as carbon tetrachloride recently has been found effective. This treatment has been administered to many flocks with excellent results. The dose is one cc. given in capsule and the cost per treatment is approximately 3 cents.

Stomach worm infestations of sheep not known to exist in California were found in a number of instances. Perhaps the parasites had not been recognized for some time because of their very small size which renders their detection rather difficult to one not familiar with their appearance in the stomach. These worms may be found in large numbers in the fourth stomach, and, since they are blood suckers, they present a reddish-pink color. The blood of the animal infested becomes impoverished, which gives rise to the characteristic symptoms of anemia

*By Dr. R. H. Mills, Senior Field Veterinarian.

and edema. Infected sheep become unthrifty and emaciated and many die. The treatment consists of one to three ounces of a 1 per cent solution of copper sulphate, depending on the size of the animal. Frequently tapeworms are found in conjunction with stomach worms, in which cases nicotine sulphate can be added to the above remedy, rendering it effective against both species of parasites. Infestations of stomach worms in sheep were found by inspectors of this Division in approximately twenty instances quite generally distributed over the northern part of the state.

A change of pasture to high ground if possible should be made as a control measure in most internal parasitic diseases.

MEAT INSPECTION *

The number of establishments operating under state inspection at the close of the last calendar year was ninety-six, employing seventy-one inspectors. This is an increase of ten establishments over the previous year.

Sixty-one cities and nine counties in California now have ordinances permitting the sale of inspected meats only, which is a gain of eleven cities and three counties over the previous year. This indicates the ever-increasing trend of the public towards protection of its meat food supply, and as the majority of these cities and counties permit the sale of state or federal inspected products only, it shows the increasing burden and responsibility which the state meat inspection service is expected to assume.

In addition to providing ante- and post-mortem inspection of all animals slaughtered in the ninety-six official slaughtering establishments, the state also is charged by law with the sanitary supervision of approximately 1200 other slaughterhouses located outside of the several large cities and counties which maintain their own meat inspection systems. Unfortunately, with the inadequate facilities which are provided, these numerous establishments can not be given the supervision that the law contemplates and which is so plainly evident if one may judge from the fact that since the enactment of this law some 450 unsanitary slaughterhouses have been condemned outright as unfit places for the handling of meat for human food.

In order also that inspection work in the ninety-six official establishments be carried on with the highest degree of efficiency, it is necessary that the work of the inspectors be under the constant check of traveling supervisory inspectors. It is axiomatic that uniformity and efficiency suffer with inadequate supervision, regardless of the line of endeavor. Unscrupulous persons will not hesitate to take advantage of such a situation should they decide that the opportunity exists. As an example thereof, attention is called to the attempt that was made to bribe an inspector by the owners of an official establishment. Fortunately, for the good of the service, they picked the wrong man and the report of the attempt, with the money that was passed, immediately

* By Dr. George Gordon, In Charge of Meat Inspection.

was turned over to headquarters. In this connection punishment of the offenders was thwarted by the inadequacy of the bribery law.

In order to bring state meat inspection up to the highest degree of efficiency, it is recommended that adequate provisions be made for carrying out the spirit of the meat inspection law by placing in the field a sufficient number of trained traveling inspectors whose duty it shall be to make frequent visits to and inspections of these establishments. At the present time only two inspectors are employed for this purpose, but it is plainly evident that at least three more are necessary.

It also has been suggested that all slaughterhouses, except those of chartered cities with civil service requirements for meat inspectors, which are exempt from the provisions of the state law, be regulated by licensing. Under such provisions the slaughtering of animals for human food would be permitted only in establishments holding state licenses dependent upon their sanitary maintenance. It has been suggested also that a nominal annual fee be charged for such a license and a fund be created therefrom out of which the expenses of such supervision could be paid.

State meat inspection in official establishments is a self-supporting function, the cost thereof being borne by the owners of the establishments. Meat inspectors must be graduates of recognized veterinary colleges and qualify for appointment by State Civil Service examinations.

It is becoming increasingly difficult to find capable men who will accept positions in this service at the present rate of pay, which is $150 and $170 per month. It is recommended, therefore, that the fee for this service be increased slightly in order that such salaries shall be raised in accordance with the grading recently given meat inspectors by the Civil Service Commission.

The charts which follow graphically tell the story of state meat inspection from 1922 to 1927, inclusive.

REPORT OF CALIFORNIA STATE MEAT INSPECTION SINCE ITS INAUGURATION

1922

Species	Animals killed	Animals condemned	Parts condemned	Pounds condemned	Average cost per species	Average cost per pound	Approximate number pounds killed	Per cent condemned
Cattle	28,757	527	5,167	307,983	$4,111 01	3/100 of 1 cent	14,378,500	1 83/100%
Calves	26,537	47	76	4,474	3,810 33	15/100 of 1 cent	2,653,700	18/100 of 1%
Sheep	56,363	32	6,001	16,915	8,106 27	29/100 of 1 cent	2,818,150	6/100 of 1%
Swine	34,858	353	7,451	92,147	5,010 28	9/100 of 1 cent	5,228,700	1 1/100%
Goats	658	0	6	12	94 75	29/100 of 1 cent	32,900	
Totals	147,173	959	18,701	421,531	$21,132 64	8/100 of 1 cent	25,111,950	65/100 of 1%

Total cost of inspection, $21,132.64.
Average cost per animal, $0.14.

1923

Species	Animals killed	Animals condemned	Parts condemned	Pounds condemned	Average cost per species	Average cost per pound	Approximate number pounds killed	Per cent condemned
Cattle	61,387	950	10,807	653 757	$8,250 01	3/100 of 1 cent	30,693,500	1 55/100%
Calves	56,402	94	210	8 852	7,720 06	14/100 of 1 cent	5,640,200	17/100 of 1%
Sheep	108,956	87	14,878	40,231	14,622 97	27/100 of 1 cent	5,347,800	8/100 of 1%
Swine	82,900	433	15,317	153,002	11,349 30	9/100 of 1 cent	12,465,000	52/100 of 1%
Goats	950	0	3	4	135 63	27/100 of 1 cent	49,500	
Totals	308,635	1,564	41,215	$55,846	$42,177 97	8/100 of 1 cent	54,166,000	51/100 of 1%

Total cost of inspection, $42,177.97.
Average cost per animal, $0.14.

1924

Species	Animals killed	Animals condemned	Parts condemned	Pounds condemned	Average cost per species	Average cost per pound	Approximate number pounds killed	Per cent condemned
Cattle	105,563	1,920	18,923	1,186,381	$17,222 32	3/100 of 1 cent	52,781,500	1 82/100%
Calves	121,918	568	405	41,486	19,649 12	16/100 of 1 cent	12,191,800	47/100 of 1%
Sheep	164,769	304	17,858	56,611	26,826 57	32/100 of 1 cent	8,238,450	18/100 of 1%
Swine	142,121	990	29,452	306,164	23,092 03	11/100 of 1 cent	21,318,150	70/100 of 1%
Goats	2,482	6	12	316	364 50	21/100 of 1 cent	124,100	24/100 of 1%
Totals	535,953	3,788	66,220	1,590,908	$87,154 54	9/100 of 1 cent	94,564,000	71/100 of 1%

Total cost of inspection, $87,154.54.
Average cost per animal, $0.16.

1925

Species	Animals killed	Animals condemned	Parts condemned	Pounds condemned	Average cost per species	Average cost per pound	Approximate number pounds killed	Per cent condemned
Cattle	137,682	2,904	29,269	1,889,648	$25,521 17	4/100 of 1 cent	68,841,000	2 1/10%
Calves	155,707	867	655	60,484	28,809 80	18/100 of 1 cent	15,570,700	55/100 of 1%
Sheep	137,823	395	18,675	62,941	25,527 26	37/100 of 1 cent	6,891,150	28/100 of 1%
Swine	129,294	1,038	30,604	319,177	23,928 39	12/100 of 1 cent	19,394,100	80/100 of 1%
Goats	2,187	17	29	912	404 60	37/100 of 1 cent	109,350	78/100 of 1%
Totals	562,693	5,221	79,232	2,336,762	$104,191 22	9/100 of 1 cent	110,806,300	93/100 of 1%

Total cost of inspection, $104,191.22.
Average cost per animal, $0.18.

1926

Cattle	145,214	3,163	31,122	2,012,019	$26,274 74	4/100 of 1 cent	72,607,000	2 17/100%
Calves	161,398	464	596	37,738	29,213 03	18/100 of 1 cent	16,139,800	29/100 of 1%
Sheep	146,414	536	17,608	71,324	26,500 93	37/100 of 1 cent	7,320,700	36/100 of 1%
Swine	121,291	697	25,479	249,718	21,953 76	12/100 of 1 cent	18,193,725	57/100 of 1%
Goats	1,573	3	14	269	284 91	37/100 of 1 cent	78,650	
Totals	575,890	4,863	74,819	2,371,068	$104,227 37	9/100 of 1 cent	114,339,875	84/100 of 1%

Total cost of inspection, $104,227.55.
Average cost per animal, $0.18.

1927

Cattle	144,307	3,111	33,051	1,907,200	$26,256 76	4/100 of 1 cent	72,153,500	2 16/100%
Calves	153,304	650	531	41,946	27,876 22	18/100 of 1 cent	15,330,400	42/100 of 1%
Sheep	137,621	443	15,170	54,242	25,051 78	37/100 of 1 cent	6,881,050	32/100 of 1%
Swine	131,633	700	29,453	271,011	23,973 94	12/100 of 1 cent	19,744,950	53/100 of 1%
Goats	1,568	5	11	195	282 31	36/100 of 1 cent	78,400	32/100 of 1%
Totals	568,433	4,909	78,216	2,274,594	$103,441 01	9/100 of 1 cent	114,188,300	86/100 of 1%

Total cost of inspection, $103,441.01.
Average cost per animal, $0.18.

CATTLE PROTECTION SERVICE*

The expiration of 1927 marked the tenth year of the work of the Cattle Protection Service, which organization, a part of the Division of Animal Industry of the State Department of Agriculture, is charged with the enforcement of the provisions originally contained in chapter 678 of the act of May 28, 1917, and of the subsequent act of June 3, 1921, chapter 725, known as the Hide and Brand Law, and chapter 726, known as the Estray Cattle Act.

When consideration is given to the fact that many thousands of cattle are turned out annually on the open ranges, forest reserves and grazing areas of California, some method of determining the ownership of these cattle is necessary and the use of a "fire brand" to identify such ownership has been found most expedient and practical. When such brands can be recorded, as is now being done, in one office, under the supervision of a State Department, such a record can be used to prevent the theft and loss of cattle and save thousands of dollars each year to owners.

The following figures give some idea of the extent of the range cattle business in California:

Number of cattle on ranges	1,320,803
Number of California range cattle slaughtered:	
Steers	378,608
Cows	373,108
Calves	432,972
Bulls and stags	14,114

In order to prevent cattle from being shipped from the ranges without the consent or knowledge of the owner and to protect cattle producers from a considerable annual loss a system of brand inspection is now provided. The absolute necessity for this legislation was easily apparent. Heretofore, no check was made of cattle shipped from the ranges of the state and no information was available whereby it could be determined whether a person shipping cattle was in legal possession. Some shippers and buyers made no particular effort to ascertain whether or not the cattle they bought were the property of the person selling them. They accepted the cattle offered to them without question, the cattle were shipped and generally slaughtered immediately at point of destination. The hides from these cattle, taking their place in the "hide pile" with hundreds of others made any attempt to trace lost or stolen cattle generally unsuccessful. This indifference on the part of some of the cattle buyers was also practiced by some of the slaughterers in the state and cattlemen had every reason to believe that many lost or stolen cattle found their way to the local slaughtering establishment where they were illegally slaughtered.

Under the present Hide and Brand Inspection Regulations no cattle can be accepted by any common carrier, for shipment, until such cattle are first inspected for marks and brands by a duly authorized Hide and Brand Inspector, appointed by the Director of Agriculture and the rights of ownership or possession of the cattle by the shipper or slaughterer fully established, and no cattle can be slaughtered in any slaughtering establishment without such brand inspection. As a further

* By Arthur Hebbron, Secretary Cattle Protection Service.

protection, a system of hide inspection is provided to permit of a checking up and an inspection of all hides "taken off" cattle slaughtered in small slaughtering establishments too remote to permit of daily full-time brand inspection, and hides can not be removed from place of slaughter or accepted for shipment or transportation by any person until they have first been inspected for marks and brands. In order to carry out this system of cattle and hide inspection, the brand records are of first importance, as these records show the design of a brand, the location it is to be placed on the animal, the name and address of the recorder and the place where the cattle so branded generally range. A list of these records is compiled with due regularity and furnished to inspectors, whereby they may be fully informed as to the ownership of any branded animal coming under their observation at time of inspection.

As a further benefit to the cattlemen, the state brand records made it possible to remedy the law pertaining to the sale of estrays. Chapter 726, an act approved June 3, 1921, requires that before any person can sell any branded cattle as an "estray" he first must give the Director of Agriculture ten day's notice by registered mail of such proposed sale, describing the brands and marks on the estray cattle, in order that the director may cause search to be made of the registered brands on file to determine the ownership of the estray cattle and give notice to the owner before date of sale, where such cattle may be found and claimed. The need for this law is undoubtedly appreciated and could only be enforced under the present system of brand registration. Many cattlemen now avail themselves of the opportunity to refer to the records in order to ascertain the ownership of any estray cattle they may find on their ranges and when the recorder of a brand on such reported estray cattle can be determined this office thus has been able to assist in restoring the cattle to the rightful owner. Our success in this work to date has been very gratifying.

It frequently occurs that we are asked to find the owners of cattle carrying brands that do not appear on our records. These are generally cattle branded with "irons" that are being used illegally or cattle brought into California from adjoining states, which have not been rebranded with a California recorded branding iron.

In order to carry out the brand inspection requirements of the Hide and Brand Law, it was necessary that a sufficient number of brand inspectors be appointed, authorized to inspect cattle and hides for marks and brands at all shipping points and to inspect cattle at all slaughtering establishments prior to slaughter. On account of the small compensation that can be earned by many of these inspectors, particularly those needed to make brand inspection in districts where a limited number of shipments of cattle originate and where the loading corrals were far apart and the slaughter houses located at some distance from the home of the inspector, some difficulty was had in securing inspectors properly qualified to perform this valuable and necessary service. A good inspector is hard to find! Reading brands, at best, is a difficult job and only men who have had experience on the range can be considered good brand inspectors. In the fall of the year when the hair on an animal is long and hanging over a brand, it

is often difficult to read. An inspector should be able to read brands readily, in order that the cattle under inspection can be handled with as little disturbance as possible. Such exacting work as this and the experience necessary, coupled with the inadequate compensation offered, prevented the Department for a time securing competent inspectors, and the service was carried on under a considerable handicap, owing to incompetent and unreliable men. As the work advanced and the cattlemen began to feel the resultant benefits arising through the efforts made to enforce the law, a gratifying cooperation developed that materially assisted the Cattle Protection Service in improving its inspection force to the extent that the protection desired by the cattlemen is now being more efficiently given and our inspection force greatly improved. Our field brand inspection force is augmented by work of a number of recheck inspectors located in the corrals at the large slaughtering centers and points of destination. These "recheck" inspectors check up the inspections made by the original brand inspector. This is done in order to locate any cattle reported as missing. They also render weekly reports of all cattle arriving at these points.

The table below shows some of the activities of this work:

Number of cattle inspected since this work started in 1917	11,163,850
Number of cattle inspected during year 1927	1,468,603
Number of licensed slaughterers in 1927	1,071
Number of new brands recorded in 1927	987
Number of old brands continued in force in 1927	10,000

The methods employed in stealing cattle have, like most all other activities, undergone great changes in the past few years. In former years, when cattle rustling was resorted to as a means of earning a livelihood, it was the custom to drive the cattle away on foot, sometimes requiring the services of several men and horses for days until they could be driven to some place of concealment or until they could be disposed of through a slaughtering establishment. The slaughterer was in some instances an associate in crime but in many cases was entirely innocent of wrong intent. Since the advent of auto trucks and trailers, however, the old system of moving cattle on foot has largely given way to the more rapid method of transportation by truck, and cattle sometimes stolen as late as midnight are slaughtered early next morning at some point as much as 125 miles away. The necessity of promptly reporting to the office of Cattle Protection Service the loss of cattle by theft is therefore evident. In such cases, all hide and brand inspectors in important slaughtering centers, as well as all inspectors in surrounding country, are immediately notified.

In the last year, largely through efforts of representatives of this office, fourteen convictions for cattle stealing have been secured, (one on third trial) the culprits in all but one case getting penitentiary sentences. This office has consistently opposed probation with the result noted above.

To estimate the value of the service performed by this inspection system would be as difficult as to estimate the number of accidents prevented by a traffic officer stationed at a street crossing. The very presence of the traffic officer often prevents accidents that might occur. Brand inspectors prevent the illegal shipment and slaughter of cattle

that might and did happen, previous to the enactment of the Hide and Brand Law. In the last decade, crime has increased to a most alarming extent in all parts of the country. With such conditions prevailing and with the very high price of cattle, it is thought, were it not for the protection this law affords, that cattle stealing would assume tremendous proportions.

It is the aim of the Department continuously to improve its brand inspection service.

RAISING HIGH-PRODUCING HEALTHY DAIRY CALVES A PROFITABLE PURSUIT

By S. O'Toole, Superintendent Tuberculosis Control.

THE INCREASING efforts to eradicate tuberculosis from cattle are making it difficult for many dairymen to obtain healthy producing cows to replace those found diseased. This method of keeping up herds is much more expensive than formerly because of the increased cost of beef and the shortage of dairy cows.

On account of the prevailing situation we find an increasing valuation of young dairy stock and milk cows. After carefully considering these facts it appears that the progressive dairymen with adequate facilities will find it not only practicable but economical to undertake the raising of his own young stock.

Success in such a venture, however, depends to a large extent upon the judgment exercised in selecting calves from known high-producing, well nourished, healthy animals, and in the proper feeding thereafter under appropriate sanitary conditions until they have reached the age when, under ordinary conditions, they will require but little individual attention.

With the present demand and prevailing prices for marketable dairy products, efforts have been made to conserve these commodities for human consumption, and to substitute, in a large measure, their by-products or other ingredients for the feeding of young calves.

It has been estimated by the United States Department of Agriculture that about four-fifths of all dairy calves are raised on separated or skim milk, with grain substituted to supply the fat removed. Some dairymen who resort to this method of calf feeding find it convenient, economical, and sanitary to purchase the cheaper grades of skim milk powder in large amounts and mix it in the proper proportions with water or other liquid ingredients at the time of feeding.

The use of skim milk powder for this purpose has been tried out successfully in various parts of the country by dairymen desiring to build up clean herds to replace those having high percentages of reactors.

It seems that a similar plan might with profit be adopted on a larger scale in California, in order to supply the demand for healthy, high-producing heifers to replenish clean herds maintained principally for milk production. This method of raising healthy calves should appeal also to dairymen who pasteurize their dairy products produced by tuberculous cows which are retained until they have yielded their value in milk.

During the past few years, skim milk powder has appeared on the market quite extensively. The product is prepared by evaporating the moisture from ordinary skim milk. It is not to be regarded as a milk substitute because it contains all the food elements of the liquid by-product with only the water removed. By adding one pound of this material to nine pounds of water, it is extremely difficult to distinguish it from the original, and, according to results obtained by experiments in feeding this mixture, calves fed on it do not appear to detect the difference between it and the fresh product from which it is derived.

Following is the procedure recommended for preparing the mixture: "The water should be at a temperature of 100° Fahrenheit. The powder usually goes into solution very easily. In case of lumps it will pay to sift before attempting to mix. It may be necessary with certain brands, to add just enough water to the powder to form a thin paste, stir until no dry particles are visible, then add the remainder of the water and stir until the paste is all in solution. The mixture is now exactly the same as skim milk"

There are several advantages in feeding dry skim milk: it is clean, keeps well, is easy to handle, can be prepared easily, and the quality is uniform.

A number of brands of skim milk powder are now on the market, and may be obtained in small lots or in barrels of various sizes.

HOW TO FEED YOUNG CALVES

The selection of a suitable place on which to undertake a pursuit of this kind should receive careful consideration in order to avoid exposure of the calves to any transmissible disease that previously might have contaminated the land. Though desirable, it is not essential that the calves be far removed from tuberculous herds, provided, the proper precautions are taken against the transmission of infection therefrom. If the calves are obtained from various sources, they should be removed from their dams as soon as possible after the first nursing of the colostral milk which aids in stimulating digestion. However, in the event the dam is tuberculous, then, if possible, the calf should be removed when dropped, and fed pasteurized milk or raw milk from a known healthy cow for a week or ten days. If the whole milk fed to calves is very rich in butterfat, it should be reduced to about four per cent by diluting with skim milk or water. Also it is important that any liquid feed for young calves should be fed as nearly as possible at a temperature of 100° F.

When a calf is removed from its dam before nursing, there may be added to the first feeding of milk a tablespoonful of castor oil to promote bowel action. A fair knowledge of the care and management of calves is essential to success in such an undertaking in order to avoid the development of serious digestive disturbances from improper feeding and insanitary surroundings. In raising calves by hand, the most common trouble experienced is indigestion or scours caused from overfeeding, or by the feeding of cold or sour milk.

Determining the amount to feed a very young calf is of the utmost importance. It is much better to feed a little less than the animal requires than to overfeed. Small calves should be started feeding on

not more than eight pounds and larger ones on ten pounds per day during the first week. A gradual increase of one-half pound at a time can then be made. About three or four days should be allowed to elapse after each increase is made, and if at any time scouring is noted, the amount should be reduced. The change from whole milk to skim milk can be commenced with safety when the calf is a week or ten days old. This should be done gradually by adding one-half to a pound of skim milk daily depending on the size and vigor of the animal. When the change has been completely effected, the amount of skim milk fed daily should be gradually increased to sixteen to eighteen pounds per day. If desired, an additional amount up to twenty pounds daily may be fed when the calf is four and one-half to five months old.

Placing of grain in the milk is inadvisable. This portion of the ration should be fed after the milk is consumed. A number of different cereals are utilized for this purpose. However, for California conditions, rolled barley or equal parts of rolled barley and oats may be fed with good results, although cracked corn is considered the best grain substitute for the fat deficiency in skim milk.

In teaching the calf to eat grain, place a small amount of bran or shorts on the tongue just after it has finished drinking its milk, and while it is still sucking its tongue. In this way, the animal becomes accustomed to the taste of grain, which it will eat thereafter from the pail, and, later, from a box placed at a convenient height from the floor or ground. When a vigorous calf is about two weeks old, it should be provided with a small amount of roughage such as a good quality of alfalfa or clover hay.

WHY RAISE GOOD HEIFER CALVES

In some sections of the country, where there is a heavy demand for the entire production of whole milk, skillful feeders have raised calves successfully on milk substitutes such as bean soup and various calf meal preparations. Satisfactory results in this undertaking, however, require exceptional knowledge of calf dietetics.

The raising of good heifer calves should appeal, particularly, to owners of accredited herds and ranchers in modified accredited areas. First, calf heifers and young cows command a good price, and ready buyers may be found among raw milk dairymen in practically any section of the state where there is a large market for dairy products.

The supply of such cattle in California falls considerably short of the demand at the present time, and dairymen with appropriate facilities should find the raising of healthy calves of good quality a means of materially increasing their income. From the present outlook, it appears that with a business of this kind well established, it might be found sufficiently profitable to warrant its development into a major activity even by ranchers or others not inclined to engage in general dairying. There is available considerable land at moderate prices in various sections of the state suitable for this purpose, and it would appear that persons seeking opportunities in agriculture might find it profitable to include in their activities the raising of some healthy dairy calves for which there now exists a favorable market in California.

REPORT OF DIVISION OF CHEMISTRY FOR 1927

FIRMAN THOMPSON, Chief.

FERTILIZER CONTROL

THE use of commercial fertilizers for improving the fertility of the soil has shown a gradual and steady increase over the past twenty years until, at the present time, the manufacture and sale of fertilizer materials has become an industry of considerable importance in itself.

Since the enactment of the first fertilizer control law in 1903 the reports of sales show that the tonnage has increased from approximately 9000 in 1904 to 94,000 in 1926. The complete tonnage reports for 1927 are not yet available, but it is estimated that it will be about 100,000 tons.

This is a natural consequence in the development of any agricultural community. Although the natural fertility of the soil may have been very high in the beginning, it gradually becomes depleted of its principal plant food elements by the cultivation and cropping practiced in intensive agriculture until it is necessary to maintain the balance by the addition of commercial fertilizers.

The chemical elements most likely to be deficient in a poor soil are nitrogen, phosphorus and potassium, and, as a consequence, the term "fertilizer" is applied to materials which contain either one, two or all three of these elements. While the term "commercial fertilizer" is not specifically defined in the fertilizer act, it is evident from a reading of its provisions that it is intended to apply to materials carrying only these three elements. While it has been known for a long time that ten elements were absolutely necessary for plant production, it was believed that seven of these were normally present in sufficient quantity. Recent investigations have shown, however, that not only are these elements often lacking or present only in a state unavailable to plants, but other elements heretofore considered unnecessary or even undesirable have marked beneficial effects when present even in minute quantity.

While fertilizer control work heretofore has consisted principally of analyzing these products for nitrogen, phosphorus and potassium in their various forms to determine their agreement with the guarantee, it is obvious that in the light of the newer knowledge materials not hitherto considered of value in plant nutrition will be offered for sale, claiming effects which may or may not be justified. Recognizing such a probability, the legislature of 1927 passed an amendment to the fertilizer act giving the Director of Agriculture the power to refuse or cancel registration of materials that are of little value, are injurious, or for which false or misleading claims are made. This should materially strengthen the law and provide an added safeguard to the consumers of these products.

The analytical work of the past year has shown that by far the greatest number of deficiencies are in the element, nitrogen, and particularly in organic nitrogen. Since nitrogen is much the most expensive contituent of fertilizers, this might be expected as a natural

consequence. However, the scarcity of the "organic ammoniates" such as tankage, fish scrap, blood, etc., is becoming more pronounced from year to year, making it difficult to obtain sufficient quantities at reasonable prices for fertilizer needs. This situation is caused by an increased use of these products in the preparation of animal and poultry feeds.

In the enforcement of the fertilizer act during the year there were nine prosecutions for deficiencies in composition. All of these resulted in convictions and the usual fines were imposed. Many other cases where deficiencies were found have been adjusted by rebates to the consumer commensurate with the amount of the deficiency. Ninety-five fertilizer licenses and forty-one agricultural mineral licenses were issued during the year to manufacturers and dealers. Four hundred twenty-five official and one hundred forty-three unofficial samples of fertilizers were analyzed in the laboratory. Also there were ninety-four official and twenty-six unofficial samples of agricultural minerals analyzed.

FERTILIZER SALESMEN CONTROL

The legislature of 1927 passed an act still further extending the governmental control of the sale of fertilizers. This is known as the fertilizer salesmen's act and provides that all persons or firms engaged in the sale of fertilizers must be licensed by the Department of Agriculture. While the license fee is nominal, the Director of Agriculture is authorized to refuse or revoke licenses for cause and the penalty for selling fertilizers without a license is rather severe. Although this law was in effect only the last five months of the year, it was found very useful in curbing some rather extravagant claims that were being made.

This law has attracted wide attention throughout the United States and is, without doubt, the most advanced step in this direction yet taken by any state. It is worthy of note that this law was sponsored from the beginning by the California Fertilizer Association, an organization of manufacturers and dealers, and is a recognition by them of the fact that a sane and reasonable fertilizer control is of as much protection to them as to the purchasers of their products.

ECONOMIC POISON CONTROL

The economic poison act is designed to regulate the sale of all materials intended for the control of all animal and plant pests. It is quite evident that this includes a wide range of substances and mixtures, and while many are recognized preparations whose efficiency is beyond question, there are many other new and untried mixtures for which extravagant claims are made. The law presumes that some inquiry as to the efficacy of these preparations will be made before licenses for their sale are granted. Although the Division of Chemistry is without adequate facilities for the practical testing of many of these nostrums, many licenses are withheld until obviously extravagant and untrue statements are eliminated from labels and advertising literature.

The Division of Chemistry definitely has committed itself to the policy of standardizing materials which are commonly used for definite

purposes. The law empowers the Director of Agriculture to make such rules and regulations as appear to him necessary for its proper enforcement. Under this provision he can establish specifications for a certain product and prohibit its sale under the usual trade name if it does not comply with these specifications. The effect of such a ruling is to standardize the product so that all brands found on the market are of uniform quality and insure to the user more dependable results. In carrying out this policy a ruling was issued in 1926 establishing specifications for basic arsenate of lead. This product has very definite uses and is particularly desirable in the control of codling moth on walnuts since there is less danger from burning by its use. Previous to the issuance of this ruling many brands of so-called basic arsenate of lead were in reality mixtures of acid and basic arsenate and their use often resulted in severe injury to the trees. Since this ruling has been in effect no reports of injury of this kind have been received and it is proposed to issue a similar ruling on lime sulphur solutions during the present year.

During the calendar year 1927 four hundred two licenses were issued for the sale of economic poisons. Of these, one hundred twelve were exempt from the fee, being either for issue to public officials or for the sale of household remedies whose value was less than $500 per year. Seven hundred fifty-nine official, and one hundred sixty-six unofficial samples were analyzed in the laboratory during the year.

SPRAY RESIDUE CONTROL

Following the experience of 1926 the spray residue work was continued and considerably extended. In February, 1927, a meeting of officials of the United States Bureau of Chemistry with representatives of the shippers, growers and law enforcement officials of the Pacific slope states was held in Salt Lake City. It was agreed at this meeting that while the acid dipping process for the removal of spray residue had been shown to be efficient and entirely practical, there had not been sufficient time to develop economical equipment for this purpose, and therefore some leniency should be shown for the year 1927. The representatives of the United States Bureau of Chemistry then stated that while their official tolerance would be .01 of a grain of arsenic trioxide per pound, no seizures or prosecutions would be made during the season of 1927 if the fruit did not carry more than .025 grains per pound, but that a tolerance of .01 grain would be insisted upon for 1928 and thereafter. The result of this was that a double standard for 1927 was established—.025 of a grain per pound for domestic shipments, and .01 of a grain for export shipments.

Following this meeting a bill was drafted and presented to the legislature specifically providing for the control of spray residue on fruits and vegetables and charging the Department of Agriculture with its enforcement. With several amendments this bill was passed and approved by the Governor on May 28, 1927, and became effective at once as an emergency measure.

The policy of the Department of Agriculture, in the enforcement of this act, is to instruct the grower how to condition his fruit so it will

meet the requirements of health authorities on arrival at its destination. All inspections are made in the field and packing house, and all questionable fruit is held at the source until it has been satisfactorily reconditioned. Thereby much needless expense and loss is prevented and this policy generally meets with the hearty approval of the growers and shippers.

In 1926 our inspection was limited to interstate and export shipments of apples and pears only, but in 1927 the field was extended to include intrastate shipments as well, and also vegetables as well as fruits. In Los Angeles and Orange counties there are large acreages of peppers and tomatoes which usually are dusted heavily with arsenical dusts. The tomatoes are marketed in a firm condition; having a smooth surface they can be wiped easily and therefore offer no special difficulty. With peppers, however, the rough surface prevents satisfactory wiping, and it was necessary to wash them with acid. Since there had been no previous experience with acid on peppers some preliminary tests were made which indicated that no injury resulted when the peppers were sound, so this practice was followed quite generally.

Spray residue conditions in California vary widely in different districts. Some spray very lightly, while others spray very heavily. The Santa Clara Valley and Yucaipa districts are probably the heaviest users of sprays, and it is impossible to bring their fruit down to the export tolerance except by acid washing. This method was widely used in the Santa Clara Valley on pears this year with entire satisfaction. With proper equipment the cost of the treatment is very low and no reports of damage in storage have been received. In the Yucaipa district neither wiping nor washing equipment has been installed generally and hand-wiping commonly is practiced. With the lowered tolerance for 1928 it is believed that this district will have considerable difficulty in meeting the requirements.

The enforcement of this law requires the employment of a number of inspectors for about four or five months in each year, the number varying considerably during that time. A maximum of thirteen men was employed in 1927. It has been deemed advisable to retain the nucleus of an organization from year to year, and accordingly one chief inspector and one chemist in Sacramento and one inspector in Los Angeles are permanent employees.

All export shipments require a certificate of chemical analysis and this service was given by the Division of Chemistry free of charge. In order to facilitate these shipments three field laboratories were established, one at Sebastopol, one at San Jose and one at Watsonville, and two additional chemists were employed. Some of this work also was done by the permanent laboratory in Sacramento. A total of 1540 such analyses was made during the season, nearly all representing carload lots. Export shipments made from the Watsonville district throughout the winter are taken care of by the Sacramento laboratory. There have been no domestic seizures and only two reports have come from England that excessive residue was found on California fruit. There were no prosecutions for violations of the law.

SOME DATA CONCERNING THE COMPOSITION OF CALIFORNIA CREAMS

By N. C. Smith, Acting Chemist in Charge, Dairy Laboratory, Division of Chemistry, State Department of Agriculture.

INTRODUCTION

THE Dairy Laboratory is frequently called upon to determine whether or not cream has been adulterated by the addition of a neutralizer for the purpose of neutralizing acidity that had developed. Likewise it is the duty of this laboratory frequently to examine cream suspected of adulteration with foreign fats or oils. The work reported in this paper was undertaken in order that we might secure some information regarding the normal composition of California creams as regards their ash content, its composition and reaction, and the chemical and physical properties of the butterfat.

Section 10 of the General Dairy Law of this state prohibits the addition of any chemical to dairy products for the purpose of arresting fermentation or preventing the progress of normal fermentative or putrefactive processes. It is conceivable that unscrupulous dairymen or creameries may alter the reaction of this cream by the addition of neutralizer to cream in which fermentation had proceeded to a considerable extent, thereby marketing a product as first grade which in reality, from an acidity standpoint, should be classed in grade two or grade three. Similarly, a slightly sour cream may be made sweet and sold as sweet cream. It is not believed that this practice is indulged in to any considerable extent; yet it is essentially the function of the Department of Agriculture and, specifically, of this laboratory to detect this form of adulteration, or deception when it occurs. Any neutralizing material used would be found in the ash of the cream and would cause an increase in the alkalinity of the ash of a cream neutralized in proportion to the amount of the agent used. It is understood, of course, that the common use of neutralizers in cream intended for butter making is not considered in this discussion. Specific provision is made for the use of alkalies and of salt in the manufacture of butter in the California Dairy Law. (Section 10 and Regulation III, paragraph 2 of the General Dairy Law.)

The calcium content of the ash of milk and of products derived from milk has been determined by several investigators and reported by Wichmann (1). Leach (2) gives the percentage of calcium oxide in the ash of typical milk as 20 per cent. Blyth (3) found from 17.31 to 27.55 with a mean of 22 per cent. Tibbles (4) quotes an analysis by Scroth reporting calcium oxide as 21.45 per cent of the ash of milk. Köstler (5) reports values for calcium oxide in the ash of milk, cream, buttermilk and butter. His maximum and minimum figures are given in Table No. 1.

TABLE No. 1

Percentages of Calcium Oxide in the Ash of Dairy Pooducts, as Calculated by Köstler

Substance	No. of analyses	Calcium Oxide in Ash	
		Maximum %	Minimum %
Milk	10	24.63	22.24
Skim milk	1	24.48	----
Cream	1	23.09	
Buttermilk	19	24.53	21.22
Butter	11	22.03	20.07

Wichmann (6) found in twenty-two Denver creams before liming, the following values for ash, alkalinity of ash, calcium oxide in the ash, and calcium oxide in the cream, which appear in Table No. 2.

TABLE No. 2

Analysis of Ash of Denver Creams Before Liming According to Wichmann

	Maximum	*Minimum*	*Average*
Ash, (fat free basis) %	.83	.53	.69
Alkalinity of ash* (fat free basis)	78.4	51.4	66.3
CaO in the ash, %	25.0	20.5	23.1
CaO in cream (fat free basis) %	.193	.123	.161

*Ml. of N/10 HCl per 100 grams of cream (methyl orange indicator).

On the basis of his analyses Wichmann gives what appear to be conservative maximum values for unneutralized cream:

Alkalinity of ash on fat free basis (c.c. N/10 acid per 100 grams)	80.00
CaO in cream on fat free basis, per cent	.20
CaO in ash, per cent	25.00

Richmond (7) states that the composition of the ash of cream differs in no respect from that of milk and gives 23.41 per cent CaO as the figure for lime according to Fleishmann.

Although some figures for ash content and for alkalinity of ash have been obtained on creams in other sections, values for California creams are not available, so far as we have been able to ascertain. Hence, in order to secure a basis of comparison in cases of suspected neutralization it was deemed advisable to accumulate some figures on the ash content and the alkalinity of the ash for typical California creams.

Another phase of the investigation is concerned with information necessary for the proper enforcement of section 9, paragraph (a) of the General Dairy Law which defines milk fat or butterfat. In order that any adulteration of the fat present in the various dairy products might be detected with reasonable speed and accuracy it was considered highly desirable that certain chemical and physical constants be determined upon the purified fat separated from California creams. It has long been known that these constants vary somewhat depending upon kind and amounts of feed received by the cows, breed of cows, period of lactation, health of the cow, temperature and climatic conditions, and, so-called idiosynerasies of the cow. It is fairly well established, however, that the most significant and characteristic constants of butterfat produced by cows in good health, properly cared for and maintained on a sufficient and properly balanced diet, vary only within fairly narrow limits.

The federal and state laws place the lower limit for Reichert-Meissl number at 24. Genuine butterfat which does not meet this standard requirement is exceedingly rare (9). It has been shown that the saponification value varies within quite narrow limits and that it bears a fairly constant relationship to the Reichert-Meissl number.

Spitzer & Epple (10) found from the analysis of 500 samples of creamery butter a maximum Reichert-Meissl number of 32.10, a minimum of 26.45, with an average of 29.91. For saponification values they found a maximum of 232.6, a minimum of 227.2, and an average of 230.4. Hortvet (11) reports the analyses of 30 samples of Minnesota

creamery butter which show values for Reichert-Meissl number as follows: Maximum 30.76, minimum 25.89, average 28.39.

We have, then, endeavored to present information on the physical and chemical constants of fat obtained from individual dairy herds and some from composite mixtures representing large numbers of dairy herds. It is recognized that the number of samples examined is small, yet an effort has been made to get a fair representation of the dairy sections of this state. (See Table No. 3.)

Twenty samples of cream were procured which were representative of the several dairy sections of the state. Most of these samples were from cream produced by individual herds; the balance of them were composite samples obtained at centralizers and represented a fairly large number of herds of dairy cows. Numerous chemical and physical tests were made on these samples to ascertain:

(1) The percentage of ash.

(2) Composition of the ash—its alkalinity and lime percentage.

(3) Chemical and physical constants of fat:

Saponification number.
Iodine number.
Reichert-Meissl number.
Polenske number.
Modified Valenta value.
Refractive index at 40° C.
Acidity as oleic.

PLAN OF WORK

Letters containing definite instructions for taking the samples were written to inspectors located in the various dairying sections of the state. Usually four different samples were arranged for and shipped so as to arrive at the Dairy Laboratory on the same day. A sample consisted of a quart of cream contained in a quart Mason jar or in an ordinary milk bottle tightly stoppered with a rubber stopper. It was taken by the inspector at the dairy from the cream produced on the day of the sampling and it represented a composite of that day's cream production, except in those instances where composite vat samples were obtained. This will be made clear by reference to Table No. 3.

All samples, except those obtained in the immediate vicinity of Sacramento, were iced for shipment, to minimize any possible deterioration due to bacterial growth.

TABLE No. 3—DATA CONCERNING THE BREED OF DAIRY COWS, THE LOCATION, FEEDING CONDITIONS, ETC., OF CREAM SAMPLES ANALYZED

Lab. No.	Producers	Location	Date	Breeds of Cattle
300	J. A. Harder	Nicolaus	Feb. 1, 1926	
301	A. & C. Dotta	Loyalton	Feb. 1, 1926	
332	J. Herger	Zamora	Feb. 2, 1926	
333	Dairymen of Sacramento Valley from Hood to Gridley	Sacramento Valley	Feb. 2, 1926	
1215	Frank Ambrose	Rio Linda	April 14, 1926	
1216	Dairymen of Sacramento Valley and northern foothill section	Sacramento Valley and northern foothill section	April 14, 1926	
1276	Stephenson Bros.	Elk Grove	April 15, 1926	
1277	Eric Johnson	Alturas	April 15, 1926	
3030	Harry Gacomini	Alton, Humboldt County	Sept. 22, 1926	Jersey
3031	John M. Cardniz and Company	Paige	Sept. 22, 1926	Holstein
3032	F. M. Bibbens	Modesto	Sept. 22, 1926	Holstein
3029	Fred Berta	Paso Robles	Sept. 20, 1926	Holsteins and Durhams
3255	Dairies of coastal valley section	Vicinity of Salinas	Oct. 11, 1926	
3256	Dairies of upper San Joaquin Valley section	Modesto, Turlock, Manteca, etc.	Oct. 11, 1926	
3257	Geo. Souza	French Camp	Oct. 11, 1926	Grade Holsteins
3258	Dairies of lower San Joaquin Valley	Tulare, Visalia, Porterville, Tipton, Lindsay	Oct. 11, 1926	
3583	J. Cook	Orland	Oct. 11, 1926	Registered Holsteins
3624	W. H. Thole	Sebastopol	Oct. 16, 1926	Grade Holsteins
3625	Geo. Souza	French Camp	Nov. 16, 1926	Grade Holsteins
3631	Joe Arnold	El Centro	Nov. 17, 1926	60 Holsteins 3 Guernseys 2 Jerseys

Lab. No.	Rations or feeding conditions
3030	For 85 cows, 24 hour period: linseed meal 30 lbs.; cocoanut meal 200 lbs.; rolled barley 150 lbs.; carrots 3000 lbs.; alfalfa pasture.
3031	Green alfalfa pasture, during the day, and dry alfalfa fed in evening.
3032	Per cow: 3 lbs. cocoanut meal; 8 lbs. rolled barley; alfalfa hay.
3029	Alfalfa and dry grazing.
3255	Abundance of lettuce, dry alfalfa and dry grazing.
3256	Alfalfa hay, rolled barley, cocoanut meal, beet pulp, and prepared mashes.
3257	Alfalfa hay (in excess); cocoanut meal 4½ lbs.; ground barley 4½ lbs.
3258	Alfalfa pasture, alfalfa hay and small quantity of grain.
3583	Alfalfa hay, oat hay, 8 lbs. of mixture, equal parts of gr. barley, cocoanut meal and bran.
3264	Oat hay, volunteer hay plus small amounts of beet pulp and molasses meal.
3265	Pasture and alfalfa hay; 4½ lbs. barley; 4½ lbs. cocoanut meal.
3631	Green alfalfa and alfalfa hay only.

PREPARATION OF SAMPLE FOR ANALYSIS

Upon receipt of the sample at the laboratory the cream was divided roughly into two portions. Approximately eight ounces of each sample were placed in a clean, dry, well stoppered bottle. This portion was set aside for chemical determinations. The balance of the sample was placed in a Dazey churn of one quart capacity, which was then connected up with a small electric motor, so geared as to impart approximately 275 r.p.m. to the churn paddle. The butter obtained was worked and washed and then melted in a beaker at a temperature not exceeding 60° C. As the curd and moisture layer separated from the clear fat, the latter was decanted into a second beaker and the layer of curd, water and some of the fat which remained, was rejected. The beaker containing the clearer fat was permitted to stand in a warm water bath not exceeding 60° C., until the fat layer became quite clear and transparent. This clear fat layer was then decanted off into another container and the small amount of water left in the beaker was

rejected. The fat, which now appeared absolutely clear and transparent, was filtered on a hot water funnel at a temperature not exceeding 60° C. The filtered fat was transferred to clean, dry, tightly stoppered bottles which were placed in a cabinet away from the light and at a more even temperature than that to be found elsewhere in the laboratory.

METHODS OF ANALYSIS

Cream

Fat: The regular Babcock procedure was used and all details of technique which appear in the A.O.A.C. Book of Methods (12) were rigidly observed.

Ash: The percentage of ash was determined substantially in accordance with the method of Wichmann (13). From 35 to 50 grams of cream were weighed out into 100 ml. platinum dishes and these placed on a hot plate to drive off the moisture; very substantial blackening of the residue gives sufficient indication of the complete loss of moisture. The dishes were then placed over a low flame of the Bunsen burner, applied to one edge or side of the dish. Spattering of the fat can be largely avoided at this point if care be exercised. The writer has found that placing a disc of ash-free filter paper fitted over the material in the dish is a great aid in preventing spattering. Some of the fat will ignite and should be permitted to burn off as slowly as possible. The charred residue was then transferred to a muffle furnace and burned to a white ash at a low red heat.

Alkalinity of the ash was determined by taking up the residue from the ash determination in a known quantity (not more than 30 ml. was used) of deci-normal hydrochloric acid; the platinum dish and contents were heated on the hot plate until the ash had completely dissolved. The solution was then washed into a 150 ml. beaker with a minimum quantity of water and the excess acid titrated to neutrality, using methyl orange as indicator.

Calcium Oxide was determined after making the above solution slightly acid with acetic acid, by adding to the hot solution an excess of saturated ammonium oxalate solution. After standing on a warm hot-plate for several hours the calcium oxalate was collected on a small filter and washed with hot water. The volume of the filtrate was kept under 125 ml. The foregoing procedure is practically identical with that of Wichmann. The calcium oxalate was transferred from the filter to the beaker in which precipitation was carried out and dissolved in 10–15 ml. of 20% H_2SO_4. The calcium oxalate-sulfuric acid solution was warmed to approximately 60° C. and titrated with standard $KMnO_4$ solution to the appearance of a faint pink coloration. At this point the filter paper was dropped into the beaker and the contents stirred vigorously. The titration was then completed to the proper faint pink end point; this required but a few drops additional $KMnO_4$ solution.

FAT

Analysis of the Separated and Purified Fat

The determination of the saponification number, Iodine number (Hanus), the Refractive Index at 40° C., and the free fatty acids

(calc. as oleic) were all made in accordance with the A.O.A.C. Official Methods (revised 1924). There were some slight deviations from official procedures for the Reichert-Meissl number and the Polenske number. The apparatus used was precisely that prescribed in the A.O.A.C. Methods of Analysis (14) for the determination of Polenske number. The "Leffman and Beam Method—Official" for Reichert-Meissl number was used except that the time required for the collection of 110 ml. of distillate was approximately twenty-five minutes. The Polenske number was determined from the same distillation; the apparatus and filter were washed three times with water followed by three washings of 15 ml. each of neutral 90 per cent alcohol.

The modified Valenta value was obtained, using a procedure suggested by Fryer and Weston (15). The method employed was as follows (16):

"The fat or oil must be prepared for test by hot filtration on a water funnel or filtered in a water oven. If any suspicion exists that the fat may not be perfectly dry the authors recommend placing a quantity of oil in a test tube, immersing the tube in boiling water for a few minutes and inserting a dry cotton wool plug forcing the same by a spiral motion down the tube through the hot oil. By means of a Mohr pipette 2 c.c. of warm oil (about 45° or 50° C.) is introduced into the bottom of a clean dry test tube (6" x ¾").

"Then 2 c.c. of the solvent, properly prepared and adjusted is introduced into the test tube, washing down the sides. An ordinary chemical thermometer, the accuracy of which has been verified, is then placed in the tube, a cork stopper is used through which the thermometer passes, a section of the cork being cut away thus exposing the scale of the thermometer passing through the cork in order that a reading falling in this section of the instrument may be made. The bulb of the thermometer is *just* immersed in the oil-solvent mixture.

"The tube with the thermometer in it is then placed in a water bath (preferably a liter beaker) and rotated vigorously so as to insure complete and thorough mixture of the contents. The water bath is then heated slowly until the oil and solvent in the tube become a clear mixture; heat is then withdrawn and the tube allowed to cool. Rotation of the tube should be continued at frequent intervals. At the first appearance of a distinct and permanent turbidity, the reading is taken and recorded.

"The acidity of the oil must be determined and the appropriate correction applied in arriving at a figure for *true Valenta value*."

DISCUSSION

ASH

Among the neutralizing materials for cream that might be used are calcium hydrate, calcium oxide, sodium carbonate, sodium bicarbonate, magnesium oxide, and magnesium hydrate, or certain combinations of these chemicals. Wichmann found that neutralization of even so small an amount of acid as .05 per cent could be readily detected by a substantial increase in percentage of lime found in the ash; he was dealing with lime neutralizers only. It is obvious that the addition of any alkalis or alkaline earth oxides or hydroxides would contribute alkalinity to the ash as well as increase the total ash content.

Table No. 4 is a tabulation of all the values for ash content, alkalinity of ash and lime percentages both of the ash and of the cream. These results are summarized in Table No. 5, wherein the maximum, minimum, and average values are shown. From the figures obtained on the twenty samples of California cream taken from the several dairying sections of the state, we find rather wide variations in percentage of ash, and the figures for alkalinity of the ash. The figures

for percentage of lime *in the ash* vary within somewhat narrower limits. It would appear that the conservative maximum limits for unneutralized cream are as follows:

Alkalinity of ash on fat free basis (ml. N/10 acid per 100 g)	75.00
CaO in cream on fat free basis (per cent)	0.20
CaO in the ash (per cent)	27.00

TABLE No. 4—ANALYSIS OF CALIFORNIA CREAMS FOR PERCENTAGES OF FAT, ASH, AND LIME, AND FOR ALKALINITY OF ASH

Lab. No.	Fat in cream, per cent	Ash in cream, per cent	Alkalinity* of ash in cream	Calcium oxide in cream, per cent	Ash, fat-free basis, per cent	Alkalinity of ash*, fat-free basis	Calcium oxide on fat-free basis, per cent	Calcium oxide in ash, per cent
300	35.50	.468	39.78	.090	.725	61.67	.139	19.24
301	39.75	.411	36.53	.087	.682	60.63	.144	21.18
332	38.40	.430	37.28	.080	.698	60.52	.130	18.61
333	28.50	.513	43.20	.107	.717	60.42	.150	20.87
1215	40.75	.443	38.82	.087	.748	65.52	.147	19.65
1216	35.60	.454	41.50	.119	.705	64.44	.185	26.22
1276	35.80	.443	40.60	.115	.690	63.24	.179	25.97
1277	36.50	.451	42.00	.120	.710	66.14	.180	26.62
3029	28.60	.503	44.15	.104	.704	61.83	.146	20.69
3030	36.40	.442	41.00	.093	.695	64.46	.146	21.05
3031	30.00	.338	30.50	.066	.483	43.57	.094	19.54
3032	42.30	.408	33.45	.077	.707	57.97	.133	18.88
3255	34.10	.448	40.05	.092	.681	60.77	.140	20.55
3256	39.60	.427	39.65	.091	.707	65.65	.151	21.32
3257	15.50	.450	40.70	.094	.532	48.17	.111	20.90
3258	29.90	.482	43.88	.101	.688	62.60	.144	20.96
3583	32.90	.481	40.65	.095	.721	60.58	.142	19.64
3624	28.50	.522	46.55	.107	.730	65.10	.150	20.51
3625	41.45	.424	37.75	.087	.724	64.47	.149	20.52
3631	44.45	.396	34.00	.079	.713	61.21	.142	19.96
Av.	34.72	.447	39.60	.094	.688	60.95	.145	21.14

*Milliliters of N/10 hydrochloric acid required to neutralize the acidity from the ash of 100 grams of cream (methyl orange indicator).

TABLE No. 5—SHOWING MAXIMUM, MINIMUM AND AVERAGE VALUES FOR ASH, ALKALINITY OF ASH AND LIME ON 20 SAMPLES OF CALIFORNIA CREAM

	Maximum	Minimum	Average
Ash, fat-free basis, per cent	.749	.482	.689
Alkalinity of ash*, fat-free basis	66.22	43.57	60.94
CaO fat-free basis, per cent	.188	.111	.147
CaO in ash, per cent	26.54	18.87	21.13

*Ml. of N/10 HCl. per 100 grams cream (methyl orange indicator).

FAT

All chemical and physical constants which were made on the fats are tabulated in Table No. 6. Table No. 7 has been arranged to show maximum, minimum, and average values for these constants. The figures for saponification number, iodine number, Reichert-Meissl number, Polenske number, and Refractive Index all fall well within the limits for those values as given by Leach (17) with the exception of the maximum value of 41.6 for iodine number. The figures for modified Valenta value, having a maximum of 47.2 and a minimum of 41.30, with an average value of 44.27, are somewhat lower than those obtained by Hortvet (18) on Minnesota creamery butter.

TABLE No. 6—ANALYSIS OF BUTTERFAT OBTAINED FROM CALIFORNIA CREAMS

Lab. No.	Saponification number	Iodine number (Hanus)	Reichert-Meissl number	Polenske number	Modified Valenta value	Refractive index at 40°C	Acidity as oleic, per cent
300	226.6	35.1	26.7	1.97	45.59°	1.4550	.19
301	232.5	30.3	30.4	3.04	42.71°	1.4547	.36
332	226.7	36.4	28.7	1.95	46.87°	1.4553	.24
333	229.4	32.6	27.4	2.29	43.70°	1.4548	.52
1215	229.2	39.3	29.5	2.14	42.62°	1.4551	.31
1216	229.1	38.0	28.7	2.05	45.32°	1.4552	.21
1276	231.0	37.5	29.8	2.23	44.50°	1.4545	.21
1277	226.1	41.3	28.9	2.14	47.23°	1.4555	.15
3029	229.5	34.9	26.3	2.11	44.11°	1.4548	.33
3030	231.4	37.6	26.7	2.13	44.86°	1.4548	.56
3031	231.2	37.1	28.2	2.48	44.20°	1.4550	.39
3032	234.3	29.1	27.8	2.65	42.04°	1.4541	.22
3255	230.2	35.1	27.6	2.09	44.24°	1.4544	.35
3256	231.8	30.2	28.4	2.72	43.13°	1.4538	.41
3257	237.2	27.1	26.6	2.90	41.34°	1.4527	.22
3258	230.4	34.1	27.8	2.63	44.33°	1.4545	.28
3583	230.0	30.5	28.8	2.34	44.20°	1.4538	.51
3624	228.1	31.3	27.0	2.12	45.90°	1.4538	.18
3625	231.7	27.5	25.9	3.00	41.30°	1.4535	.79
3631	225.4	41.6	25.7	1.87	47.20°	1.4553	.47
Av.	230.09	34.33	27.85	2.34	44.27°	1.4545	.36

The latter investigator found a maximum of 49.4, a minimum of 46.5, with an average value of 45.57, on thirty samples. It will be noted (Table No. 6) that the higher iodine values are correlated with a corresponding rise in the modified Valenta values of the fat. While no significant correlation exists between the feeding conditions and the chemical and physical properties of the fat, it is noteworthy that in samples Nos. 3032, 3257, 3625, where a ration was used containing cocoanut meal, the iodine numbers are much lower than the average, the Polenske numbers are considerably higher than the average, and the modified Valenta values considerably lower than the average.

TABLE No. 7—MAXIMUM, MINIMUM AND AVERAGE VALUES OBTAINED FOR VARIOUS CHEMICAL AND PHYSICAL CONSTANTS ON 20 SAMPLES OF PURE BUTTERFAT

	Maximum	Minimum	Average
Saponification No.	237.2	225.4	230.1
Iodine No.	41.6	27.1	34.3
Reichert-Meissl No.	30.4	25.7	27.85
Polenske No.	3.04	1.87	2.34
Modified Valenta value	47.23	41.30	44.27
Refractive index at 40°C	1.4555	1.4527	1.4545
Acidity as oleic, per cent	.79	.15	.36

When one considers the fact that the samples examined were, in the main, from individual herds of dairy cows, were from widely separated sections of the state and were from herds of different breeds of dairy cows fed on different rations, it is reasonable to suppose that the fat constants obtained are fairly representative of California butterfat. The fact that only twenty samples were examined, of course, is a limiting factor in the wider application of this information to the systematic detection of adulterated butterfat. The analysis of a larger number of samples would be desirable in order to amplify the data presented in this paper.

ACKNOWLEDGMENTS

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SUMMARY

1. Twenty samples of California cream embracing all the major dairy sections of the state have been examined. The percentages of ash, lime and the alkalinity of the ash have been determined.

2. The percentage of lime in the ash is the least variable factor and, therefore, probably the most significant figure in determining neutralization of cream with lime.

3. Several of the chemical and physical constants on the fats separated from these creams have been determined, and it was found that in practically every instance the values lie well within the limits given by other investigators for normal butterfat.

4. The first data of this nature relative to California cream is herewith presented. It is hoped that it may serve as a tentative guide in the detection of adulterations of cream by the addition of neutralizers or by the admixture of foreign fats or oils.

5. The amount of work done might well be amplified in order to provide a basis for general conclusions.

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REPORT OF DIVISION OF MARKETS*

THE DIVISION OF MARKETS (formerly the State Market Commission) was reorganized June 1, 1926, under the direction of R. L. Adams, who held office for one year on loan from the College of Agriculture, University of California.

The original state marketing commission act was passed by the 1915 legislature, revised and revamped at the 1917 session, and in 1921, by further legislation, it was made a part of this Department. Other than a change in the personnel, the original enabling act as amended was continued in full force and effect. Today the division is proceeding under the well known commission law of 1915 the purposes of which are as follows:

First—To act as adviser for producers and distributors when requested, assisting them in economical and efficient distribution of any such products at fair prices.

Second—To gather and disseminate impartial information concerning supply, demand, prevailing prices and commercial movements, including common and cold storage of any such products.

Third—To promote, assist and encourage the organization and operation of cooperative and other associations and organizations for improving the relations and services among producers, distributors and consumers of any such products, and to protect and conserve the interests of the producers and consignors of such products.

Fourth—To foster and encourage cooperation between producers and distributors of any such products, in the interest of the general public.

Fifth—To foster and encourage the standardizing, grading, inspection, labeling, handling, storage and sale of any such products.

Sixth—To act as a mediator or arbitrator, when invited by both parties, in any controversy or issue that may arise between producers and distributors of any such products.

Seventh—To certify, for the protection of owners, buyers or creditors, when so requested, warehouse receipts for any such products, verifying quantities and qualities thereof, and to charge for such service fees sufficient to make the service at least self-supporting.

Eighth—To issue labels bearing the seal of the state market commission on request of the producer, packer, canner or distributor, for any such products, for which state labels have not otherwise been authorized by law, under such rules and regulations as the director may deem necessary and to charge for such labels such fees as in the judgment of the state market director may be proper.

Ninth—To act on behalf of the consumers of any such products in conserving and protecting their interests in every practicable way.

Tenth—To improve, broaden and extend in every practicable way, the distribution and sale of any such California products throughout the markets of the world.

Eleventh—To promote in the interest of the producer, the distributor, and consumer, economical and efficient distribution and marketing of all or any agricultural, fishery, dairy and farm products produced, grown, raised, caught, manufactured or processed within the State of California.

It shall be within the province of the state market director, hereinafter provided for, to determine and decide, when, where and to what extent, existing conditions render it necessary or advisable to carry out any or all the purposes of this act and he is herewith granted power and authority to carry out any or all of said purposes.

During the year a large number of complaints of consignors, producers and others, against consignees or buyers of agricultural products, have been investigated and in substantially every instance where

* Jan. to June, 1927, R. L. Adams was chief of the Division. From June, 1927, to March, 1928, Wells A. Sherman was chief. Burke H. Critchfield assumed the position of chief of the Division on March 1, 1928.

there was any merit behind the accusation a satisfactory settlement to complainant was obtained. The sum total of these filings ran into thousands of dollars and in one instance a complaint in which upwards of six thousand dollars was involved was adjusted to the satisfaction of both parties.

Under the provisions of the market commission act, when requested by both parties, the office settles marketing controversies by arbitration. The Division has conducted arbitration hearings in various parts of California wherein a member of the staff was by consent designated the sole arbitrator. These proceedings have resulted in a better understanding between those concerned and in every respect were far more satisfactory than the long delays, expense and other inconveniences incident to a formal court action. In every instance where complaint was adjusted by arbitration proceedings the parties were satisfied and the findings and judgment were in good faith literally complied with by both parties.

PREPARATION FOR THE PRODUCE DEALERS ACT

For more than a decade past the proposition of licensing, bonding and regulating produce dealers and commission men in California has been given careful thought and consideration by farmers' organizations, the agricultural press and others. Numerous bills of this character have been introduced at various times in both houses of the legislature, but up to the session of 1925 did not pass. The sentiment in favor of such a regulatory statute, however, had been crystallizing rapidly and at the 1925 biennial session the so-called Adams bill finally passed both houses. However, for various reasons the law failed to receive the Governor's signature. Irrespective of this setback the California Farm Bureau Federation, State Grange, Farmers Educational Union of America and the agricultural press got behind a revised bill for the legislature of 1927. It was subsequently introduced in the legislature, and was approved by the Governor June 1, 1927, and became effective August 1, 1927.

ACTIVITIES OF THE DIVISION, JUNE 1 TO DECEMBER 31, 1927

On June 1, 1927, the headquarters of the Division of Markets was transferred to Sacramento, and by agreement between the California Department of Agriculture and the Bureau of Agricultural Economics, Washington, D. C., with the full consent and approval of Governor Young and Secretary Jardine, a plan was inaugurated for bringing about a complete unification or coordination of all state and federal activities in California, which contribute service or advice in the marketing of farm products.

Under this arrangement Wells A. Sherman, who was formerly in charge of the Fruit and Vegetable Division of the Federal Bureau, became Chief of the Division of Markets of the State Department of Agriculture, while still retaining his federal status as a chief marketing specialist.

The immediate job ahead for the new chief of the Division of Markets was to prepare for the enforcement of the Produce Dealers License Act, which was to become effective August 1. Meetings were held with the produce dealers in San Francisco and Los Angeles, and the opera-

tion of the law explained. Circular letters were sent to all produce dealers in the state calling attention to the new law requiring them to take out a license and bond.

Many commission merchants proceeded to fulfill the requirements of the law, but most of the produce dealers in the bay region united in an action to test the constitutionality of the law and secured an injunction restraining the Director of Agriculture from enforcing the law against those dealers named in the stipulation for intervention.

The final decision denying the petition for permanent injunction was rendered by the superior court in San Francisco on December 31.

The canning peach growers were the first group to call upon the Division of Markets for assistance in helping to solve a very serious industry marketing problem. The growers and canners failed to agree on what should be the price for canning peaches. A deadlock followed and as a result almost the entire crop of the Tuscan variety was dropped to the ground.

In order to prevent another peach war in future years, conferences were held with small grower groups in both the northern and southern parts of the state, where plans were discussed for improving the general peach marketing problem. A largely attended mass meeting of growers was later held in Sacramento, and a tentative program agreed upon. In subsequent meetings of the committee of seven, it became evident that the various elements among the growers would not unite on any program, except better standardization of the canned product.

The very great increase in production of cling peaches that is taking place seems to be the chief obstacle standing in the way of a satisfactory price to the grower. The method of handling the surplus appeared to be the chief problem over which the committee failed to agree. At the end of the year the peach growers' committee was still holding meetings and the solution of the canning peach problem was one of the principal activities of the Division of Markets.

PRODUCE DEALERS ACT

The Produce Dealers Act became effective July 31, 1927. On August 31, 1927, an application for an injunction was filed in which 97 dealers in the bay region joined, which delayed the enforcement of the act. The application was dismissed on the afternoon of December 31.

License fees collected, 304, of which 16 were received in the latter part of December for account of 1928, leaving

Fees collected for 1927		288
License fees for accrediting		3
		285
Licenses actually issued	263	
Licenses assigned, not issued	22	
	285	285

There were forty-four complaints received and investigated of which seven were sale and purchase transactions. The total amount received through the efforts of the Department for account of the consignors and owners was $5,272.20. Of the amount, $2,075.72 was recovered on com-

plaints covering sale and purchase transactions: the balance, $3,196.48, on complaints of consignment transactions. These complaints are divided as follows:

Location	Number complaints		Recovered	
	Consigned	Purchased	Consigned	Purchased
Los Angeles	6	--	$1,224 14	--------
San Diego	1	--	955 78	--------
Santa Ana	--	1	--------	$197 29
Fresno	1	--	575 98	--------
Sacramento	--	1	--------	1,782 17
Salinas	1	--	250 00	--------
Reno, Nevada	--	1	--------	96 26
Anderson	1	--	74 15	--------
San Jose	2	--	--------	--------
San Francisco	25	--	116 43	--------
Oakland	1	--	--------	--------
Stockton	--	1	--------	--------
Oroville	--	1	--------	--------
Marysville	--	1	--------	--------
Totals	38	6	$3,196 48	$2,075 72

In making investigations of complaints it was found that almost without exception the grower has no complete or accurate record of his own part in the transaction, making it difficult to determine the facts.

FEDERAL TRADE COMMISSION FAIR TRADE PRACTICE CONFERENCE

The Federal Trade Commission invited Prof. R. L. Adams to preside at the far western conference held in San Francisco. This conference was for the purpose of bringing about a voluntary agreement and understanding among western states dealers in dairy and poultry products and to adopt and put into effect a code of ethics and fair uniform trade practice in the handling of these products both on exchanges and as individual firms. The discussions lasted several days and resulted in the adoption of many good suggestions and the elimination of a large number of unethical practices that had been heretofore impossible to curb.

STATUS OF THE ARTICHOKE INDUSTRY

At the request of the California Development Association and other interested parties there was published and disseminated under the auspices of the Division of Markets the findings of a survey of the artichoke growing and marketing situation as of January, 1927. Pertinent suggestions were made for the partial or whole solution of the somewhat chaotic conditions that seem to prevail in the marketing of this vegetable. For the past three years or more definite attempts have been made to combine artichoke growers into an organization for the purpose of bringing about better marketing. It appears, however, the attempts were wholly unsuccessful.

DECIDUOUS TREE FRUIT CLEARING HOUSE AGREEMENT

The first agreement drawn in California having for its purpose the creation of a clearing house organization to furnish data and informa-

tion to member shippers of deciduous fruits was formulated and drawn by the Division of Markets. Following state-wide conferences participated in by the large deciduous fruit distributors, both cooperative and noncooperative, the Division of Markets, at their request, planned the "set-up" member contract and by-laws of the contemplated 1927 clearing house. The requisite number of shippers did not sign up for the season of 1927, and the enterprise temporarily was dropped.

STATE FISH EXCHANGE

B. B. Florence, Secretary.

CALIFORNIA leads all other states in the Union in volume and value of her fisheries. For the twelve months period ending June 30, 1927, the production amounted to 389,253,670 pounds, valued at $25,000,000. This was the second largest catch in ten years and is exceeded only by the catch in 1925, which amounted to 414,753,312 pounds.

Represented in this production are about fifty species of fish, about twenty of which are important commercially. Sardines top the list by a wide margin, 298,917,572 pounds being taken, constituting about three-fourths of the total tonnage. Skipjack ranks second with a catch of 14,262,897 pounds, and sole third with 9,222,798 pounds. The albacore season of 1927 was a failure, only 2,313,435 pounds being landed while in 1925 over 21,000,000 pounds were taken. Salmon still ranks among the first with a catch in 1927 of 6,414,329 pounds.

The catch of shellfish and crustaceans for the period ending June 30, 1927, was 14,575,967 pounds, several million pounds greater than at any time during the last ten years. This increase in tonnage was due principally to a large catch of squid, 5,677,952 pounds being landed. This amount is almost double that of any previous year. From a commercial standpoint crab is the most important shell fish in California, 3,342,162 pounds being caught last year. Abalone is next with a production of 2,489,857 pounds, all of which is consumed in California as the law prohibits shipment of abalone out of the state. About 90 per cent of this distinctive California mollusk is sold fresh in the form of steaks.

A large tonnage of fish and shellfish is brought into California from Mexico, 28,532,118 pounds having come in during the season ended June 30, 1927.

Three-fourths of the fish caught in California is either canned or cured. There are about sixty-five canners and packers in the state employing some 5000 persons; of these thirty-one are engaged in canning sardines, albacore, tuna, and skipjack. The balance are engaged either in salting or smoking fish. The fresh fish markets are supplied by sixty-six wholesalers located mostly in Los Angeles and San Francisco, who sell through some 3000 retail dealers scattered throughout the state. There are over 500 retail establishments in San Francisco and probably double that number in Los Angeles and in sister cities.

It is difficult to estimate the amount of money invested in the production end of the industry. There are over 2000 boats engaged in fishing, the value of which probably is close to $10,000,000. The value of the packing plants is estimated at over $6,000,000, while the money invested in store fixtures in the retail houses probably runs close to another $5,000,000. There are about 5000 men engaged in commercial fishing in California and the canners employ a like number. Altogether it is estimated that there are 15,000 persons engaged in our fishing industry.

A number of wholesalers in California are experimenting with parchment wrapped fillets and also package fish. Some of the companies are shipping fillets wrapped in parchment paper to all their out of town customers and also are experimenting with the freezing of fillet of sole parchment wrapped.

In the south, Los Angeles and San Pedro, some of the largest companies are wrapping part of their production of fillet of rock-cod. One wholesaler there produced a package fish, wrapping fillets of rock-cod or mackerel in waxed paper and packing them in one-pound paper cartons. The package then was frozen and distributed to retail dealers.

This is still in the experimental stage and although fish packed in this manner has met with fair reception, the process is expensive and in order to be profitable a large volume of business would have to be done. All the leading wholesalers realize, however, that the future of the fish business is in wrapped and package fish, and they are trying to solve the practical problems involved before engaging in this method of distribution on a larger scale.

COMPARISON OF TOTAL CATCH IN CALIFORNIA; ALSO SOME IMPORTANT SPECIES

	1925 *pounds*	*1926* *pounds*	*June, 1927* *pounds*
Total catch	414,753,312	371,547,930	389,253,670
Total catch, fresh fish	404,002,066	359,926,236	374,677,703
Total catch, shell fish	10,751,246	11,621,694	14,575,967
Albacore	21,684,942	2,469,325	2,313,425
Salmon	9,525,753	6,024,527	6,414,329
Sardines	315,294,986	286,741,250	298,917,572
Skipjack	8,768,114	14,265,729	14,262,897
Sole	8,756,338	8,642,710	9,220,798
Mexican fish	22,382,587	23,058,741	28,532,118

This Department is entirely self-sustaining financially from licenses collected from those engaged in the fresh fish industry.

The following amounts were collected in licenses from July to December, 1927:

	Number of dealers	
Sideline "E"	2,637	$13,063 22
Peddlers "B"	151	746 70
Exclusive "A"	102	994 20
Wholesale "D"	59	4,525 00
Wholesale Branch "C"	32	160 00
Brokers "F"	12	600 00
		$20,089 12

In 1927 the State Fish Exchange prepared a cook book the title of which is "Five Hundred Ways to Prepare California Sea Food." This Department is using the State Fish Exchange funds to prepare this book, which will be distributed free to housewives through the medium of the fish dealers of the state.

One of the problems of the fish industry is to educate the consumer to eat more than one or two varieties of fish. By giving practical and tested recipes for all varieties produced in California it is hoped to encourage the consumption of the lesser known species of fish.

DIVISION OF WEIGHTS AND MEASURES

J. S. Casey, Chief.

DUE TO THE LARGE increase of population in California, inspections of scales, gasoline measuring pumps, and other weighing and measuring devices have greatly increased the work of Weights and Measures officials.

Capable sealers are engaged at present in protecting the purchasing public against fraud in California. The force of the Weights and Measures Division, including the county and municipal departments under its jurisdiction, numbers ninety-seven. Splendid team work prevails throughout the entire organization which functions as a smooth running unit.

The larger municipalities, such as San Francisco, Oakland, and Los Angeles, have well equipped departments that are commendably active in weights and measures work, and county and municipal departments elsewhere also display activity commensurate with the requirements in their respective territories.

FALSE AND INCORRECT SCALES ELIMINATED

A great number of incorrect scales and weighing and measuring devices were either adjusted by inspectors, condemned for use until rebuilt and repaired, or condemned and destroyed during the past year. The majority of these instruments were in busy places where they were used many times a day in weighing sugar, coffee and other valuable commodities. Had they been allowed to continue in use the loss to the consumer, and in some cases to the dealer himself, would have been tremendous. This condition is not necessarily a reflection on the merchants, for in the majority of cases they are honest and do not know that their scales are incorrect. A scale may balance perfectly and still give a false weight when a load is placed on the platform, for it will get out of adjustment the same as any other sensitive mechanism that is subject to constant use.

Not only have the scales in stores been examined but the sealers also are constantly inspecting package goods, canned products, etc., to see that the net content is correct. This includes deliveries of ice, coal, wood, groceries, loaves of bread, prints of butter, boxes of berries, and all kinds of commodities in package form. The California Net Container Act requires a statement of the net contents on the outside of every container weighing over two ounces. Before this law was enacted it was not uncommon to purchase a fine, large appearing package of some commodity only to find on opening that it was about half full. The merchant who put up an honest, well-filled package was confronted with the unfair competition of the man whose slack-filled package appeared larger on the shelf of the store, although it actually contained less. This has been corrected to a large extent.

In a half dozen instances out-of-state manufacturers have shipped into California milk bottles in excess of the standard tolerance. Each case reported, however, was handled without prosecution and with satisfaction to all parties concerned.

The purchase and sale of agricultural products and other commodities are based on the weight records of wagon, stock and auto truck

scales in every county in the state. The honesty of transaction largely depends on the accuracy of the scale. The majority of these scales are located out of doors where they are subjected to the wear of the weather. The special testing outfit used in keeping these scales up to standard is unusually efficient. It includes an overhead "I" beam, traveling block, and chain hoist which provides a quick means of handling the 500-pound test weights from the truck to the iron buggy.

PUBLIC WEIGHMASTERS

Most wagon and truck scales are operated by public weighmasters, about 1500 of whom are located in the state. They are licensed and are under bond to this Department and for a small fee any one can obtain an accurate certificate of weight for his load from one of these men.

An entire working over of the weighmaster records resulted in bringing them all up to date. New bonds were issued, proper classifications of deputy weighmasters made and a complete testing and report of all heavy tonnage scales in operation made during the year. Some laxity seemed to prevail concerning the proper application of the state seal and likewise the issuing of weight certificates. Correction and advice were given pertaining to this matter, resulting in a complete acquiescence on the part of all public weighmasters to the requirements of the Public Weighmasters Act.

PROSECUTIONS

The Weights and Measures officials handle a great majority of complaints out of court as investigation proves that they are often due to carelessness or ignorance rather than deliberate intent. However, when firms are found using unfair methods and ignoring warnings, prosecutions are instituted, and while convictions and fines are the result, the real value of these prosecutions does not lie in the amount of the fine, but in discouraging such dishonest practices.

GASOLINE MEASURING PUMPS

There are approximately 23,000 gasoline measuring pumps in this state, dispensing approximately 2,826,891 gallons of gasoline daily. These pumps are subjected to unusual conditions of wear and tear and only consistent, systematic inspection service will maintain them in an accurate condition. This one branch of the work performed by the Division of Weights and Mesaures saves the taxpayers many dollars, likewise time and annoyance to the motoring public and dealers. California led all states during 1927 in gasoline consumption.

Special equipment is used for testing and sealing large meters used on harbor docks for selling gasoline, Diesel oil, and other fuel oils to ships, large quantities thereof being measured through these meters. In order to comply with official requirements the various oil companies have improved their old meters and developed new types of higher accuracy. In some instances entire installations were torn out and replacements made under the guidance of Weights and Measures deputies before the desired accuracy could be attained.

The gauging and sealing of large tank trucks and trailers used in selling gasoline and other petroleum products from the wholesaler to

the retailer is very important. Special gauging outfits, perfected after considerable experimentation have, however, produced satisfactory results.

GREASE MEASURING DEVICES

There was perhaps no more perplexing problem before the Division during the year than the investigation of various devices used in measuring the amount of grease sold to motorists for transmission cases and differentials. Many of the "grease guns" in use were antiquated and showed shortages as high as 50 per cent. As a result of this investigation improved devices are being placed in use which measure accurately, and automatically indicate to the purchaser the amount of grease actually delivered.

STATE INSTITUTIONS INSPECTED

As prescribed by our statutes the regular annual inspection and test of state weighing and measuring apparatus in use at all state institutions in California was conducted. When repairs or adjustment in equipment were deemed necessary they were taken care of, and where devices had outlived their usefulness replacement was advised in order that the interests of the state would be safeguarded in checking commodities purchased.

SEALERS' EQUIPMENT TESTED

During the year all weights and measures devices were calibrated properly and certificates of accuracy issued.

THE BREAD ACT

Very little deviation has been encountered in the checking of bread. The law requires a standard loaf shall be not less than 16 ounces avoirdupois weight, or the standard large loaf 24 ounces. Full cooperation has been enjoyed by this office from the baking companies throughout the state.

MATTRESS AND UPHOLSTERED FURNITURE ACTS

The legislature of 1927 passed to the department for enforcement the Upholstered Furniture Law and amended the Mattress Regulation and Inspection Act. These laws are handled under this Division and require the proper labeling of all new or second-hand furniture, mattresses, pillows, comforters and art cushions. In accordance with the provisions of the law which requires that all second-hand or used materials going into the manufacture of mattresses or upholstered furniture be sterilized under regulation of the State Board of Health, revised regulations were adopted in November, 1927, and have greatly aided in the proper enforcement of these laws. Purchasers of upholstered materials would do well to see that an official label is attached stating that such materials have been properly sterilized. The inspectors from this department are now actively engaged in enforcing these regulations.

Forty-one sterilization plants are now operating throughout the state in full compliance with Board of Health regulations. These plants are under supervision of this Division and must properly perform their work in order to retain their licenses. Duplicate plans of the sterilizing cabinet must be presented for approval and the proper tests must

be made before a qualified local health officer and the recommendation of the supervising inspector of each particular territory must be secured before a permit can be granted. Permits may be revoked when, after hearing before disinterested parties, the defendant has been found guilty of wilfully violating the sterilization regulations or otherwise defying or ignoring the corrections offered by state inspectors. During the past nine months about 2700 pieces of bedding were condemned and burned.

DEALERS' LICENSES

Licenses have been issued to practically all manufacturers and dealers of upholstered furniture and mattresses in the state. Licensed dealers are insured protection in buying merchandise as labels must appear on the articles received from the wholesaler, stating nature of material contained therein. All work shops and places of business in the furniture and mattress industry as far as we have been able to ascertain are in a sanitary condition. Confiscation of second-hand and filthy material has benefited not only the public but also the people who daily labor in this industry.

PROSECUTIONS

On the records of this department are notations of prosecutions and confiscations obtained for (a) operating without license; (b) substituting inferior material for owner's good material; (c) mislabeling second-hand materials styled as new; (d) operating improper sterilizing cabinets without a permit; (e) other causes which are in direct violation of the Upholstered Furniture Law and Mattress Regulation and Inspection Act and contrary to the prescribed regulations.

SPECIAL DEFINITIONS OF PILLOW CONTENTS

It was found during the past year that manufacturers often mislabeled feather and down-filled pillows and cushions. It has been a common practice to label these commodities as filled with down when in reality they are filled with a combination of chicken and turkey feathers with perhaps a small percentage of goose or duck down. In order to protect the public from such practices standards have been established for labeling all feather and down-filled articles and these provide that the contents of a pillow shall be designated by three terms: (1) down; (2) feather fiber; (3) feathers. These designations are carefully defined in the regulations.

Another common practice that has been discouraged is the shipping into California, direct from the eastern manufacturer to the retailer, of mislabeled fancy pillows, lounge and art cushions. These were often found to be stuffed with the miscellaneous refuse from various factories, etc., and labeled "garnetted cotton." The California law distinctly specifies that such material is "shoddy" and must be sterilized before shipment and so labeled; otherwise it is either returned to the manufacturer or sterilized and properly certified by California inspectors.

The records of the Division show that for the last fiscal year there have been licensed to do business in the state 321 mattress manufacturers; 165 mattress renovators; 2803 mattress retailers; 393 furniture manufacturers; 291 furniture repairers and 1540 furniture retailers.

DIVISION OF LAND SETTLEMENT

CHARLES W. CLEARY, Chief.

THE Division of Land Settlement took over the administration of the land settlement projects at Durham and Delhi on July 29, 1927, under and by virtue of an act of the legislature of 1927 (chapter 558, Statutes 1927, p. 942).

A brief general history of State Land Settlement activity from its inception up to the time that this division was charged with the duty of administration is in order preceding consideration of conditions during the five months under report.

By act of the legislature of 1917 (Statutes 1917, p. 1566) appropriating $260 000 for the purpose, the state embarked upon an experiment in land settlement or colonization. This act was sponsored by the Commonwealth Club of San Francisco; it was the result of extended consideration and had been the subject of investigation by a Commission on Land Settlement and Rural Credits created by the legislature of 1915. The report of this commission was published in 1916 and was the basis of the legislative act of 1917 under which state land settlement has been administered. Dr. Elwood Mead, now Commissioner, Bureau of Reclamation, Department of the Interior, Washington, D. C., widely known as "the father of land settlement in California," lead all the activity in favor of the state engaging in such an experimental project from the inception of consideration of the subject.

The first colony or settlement was established at Durham, Butte County, in 1918, and consisted of 6239 acres of generally very good land under a gravity system of irrigation from Butte Creek, a stream which flowed through the tract. A detailed soil survey was made by University of California experts. The tract was divided into approximately 110 farms varying in size from 8 to 300 acres and 30 tracts of approximately two acres each known as farm laborer allotments.

The property cost the state an average of $80 per acre. General improvements by way of irrigation system, roads, etc., were made by the state and certain lands were reserved for office and administration purposes and twenty-two acres, heavily wooded with oak trees, set aside for a public park; the remainder was offered for sale to settlers on purchase contracts at prices ranging from $48 to $300 per acre, averaging $150, including water rights. (Detailed statement, page 758, this report.) Lands were priced according to values indicated by the soil survey and other apparent factors.

Settlers were selected subject to such requirements as would be calculated to insure the success of the project. In fact, in the opinion of those in charge, every precaution was taken to guard against failure of individual settlers as well as of the settlement as a whole. Settlers were required to pay down 5 per cent of the purchase price of their land, the deferred balance being amortized over a period of twenty years in semiannual installments with interest at 5 per cent per annum. The settler was required to put up 40 per cent of the cost of such improvements as buildings, leveling the land, etc., while the state advanced 60 per cent, secured by improvement contracts and amortized

over the same period as land payments, payable semiannually at the same rate of interest. Loans were made also by the state on live stock and implements, payable in installments running over a period of three years at 5 per cent.

The original appropriation was inadequate, and funds soon ran low. In order to make available more funds to "carry on," the settlers on that portion of the colony for which the state had paid cash, were asked to borrow one-half the capital value of their farms from the Federal Land Bank and pay same to the state as advance payment on their contracts of purchase. Upon the amount so borrowed, the settlers had to pay 5½ per cent interest, the rate charged by the Federal Land Bank, but they obtained the advantage of smaller payments and a longer time in which to pay. Some $97,400 was obtained in this way.

Some 1500 acres of the land originally sold to settlers has reverted to the state and been classified as unsuitable for intensive development, being heavy adobe soil. A portion of this was resold at a reduced price without water right for rice and grain culture.

General supervision of the settler's development of his farm or farm laborer's allotment was maintained by the administration of the colony and expert service in farmstead engineering and advice in all things pertaining to farming and farm development were made available; also leadership was furnished in the promotion of cooperative activity to insure the best collective marketing and purchasing practices.

So successful was the initial period of development of this colony and so eager were farmers and prospective farmers to avail themselves of the opportunity to obtain a farm or farm home on the liberal terms offered that available allotments soon were exhausted.

In 1919 the legislature appropriated $1,000,000 (Statutes 1919, p. 845) for a further extension of the land settlement program and as a result of this act 8400 acres were purchased at Delhi, Merced County. An extensive irrigation system of underground concrete pipe was installed, taking water from the canals of the Turlock Irrigation District, in which the colony lands were included. An extensive road system was laid out and improved; and in progressive units, following a detailed soil survey by University of California experts similar to that made at Durham, the land was subdivided in acreages suitable for farming or farm homes and sold on the same terms as were Durham Colony allotments, except that land payments were amortized over 36½ years instead of 20 years. By express provision of the 1919 act preference was given to ex-service men in the sale of Delhi colony farms.

This 8400-acre tract largely was very sandy soil of undulating topography and low agricultural value, requiring much leveling in preparation for cultivation, planting and irrigation. The state paid an average of $96 per acre for this land and after developing the irrigation system, the system of roads, making certain general improvements and reserving for administration and townsite purposes certain portions of the tract, the remainder was offered for settlement and a large portion of it sold to settlers at an average price of $229 per acre. (Detailed statement, page 757, this report.) Some 64 acres of rough land were sold outright for cash and 18 acres of the townsite either sold as business sites or donated for public purposes, leaving 3777 acres

now unsold, including 1066 acres formerly sold but which have reverted to the state. An additional 775 acres have reverted and been resold.

A bond issue of $10,000,000, authorized for submission to the people by the 1919 legislature (chapter 540, Statutes 1919), failed to go on the ballot because of technical defect in the legislative act. An additional $1,000,000 was appropriated by the legislature of 1921 (Statutes 1921, chapters 15 and 733) in spite of which the project soon went on the rocks and a bond issue of $3,000,000 for the extension of land settlement submitted to the people in 1922 was defeated. Settlers in Delhi, as in Durham, were asked to borrow from the Federal Land Bank, and $315,000 was obtained in this way. Through lack of funds and failure of the land to produce as expected, coupled with general agricultural depression, the situation at Delhi became critical and the legislature of 1925, following a report and recommendations by a legislative committee composed of three senators and three assemblymen who had during the constitutional recess made an investigation of the history and condition of the colony, passed a series of acts by virtue of which the selling price of the land at Delhi was reduced an average of $68 per acre, one-half by direct reduction in the price of the land and one-half in remission of interest. A delinquency of $293,237.36 on payments due from settlers on the original contracts was eliminated and written into new contracts as deferred payments on improvements and each settler started with a clean slate with no delinquency charged against him except as deferred payments on improvements at the date of the new contract, July 24, 1925. The unpaid balance due the Federal Land Bank, about $300,000, was assumed by the state.

The Delhi project, or colony, has had a stormy history since its inception except during the early period of development when credit to the settlers was easy and plenty of money was available from a source other than the production of the land.

The legislative committee above referred to in their report to the legislature of 1925, following investigation of Delhi Colony, said:

"The project as a whole has been, and now is, a financial failure. The settlers were led to expect too much; in several instances they were granted greater loans than the Land Settlement Act permitted.

"In a number of instances chattel mortgages were made by settlers to the board securing loans made by the board. Later the mortgaged chattels were sold by the mortgagors and the loans were not repaid to the board.

"Furthermore, in addition to the general expectation that more help would be given than is economically sound or larger loans made than were financially or legally proper, many of the settlers came to the colony with the distinct belief that the state would act as a sort of guardian angel or Santa Claus and 'see them through,' as they expressed it.

"The final consideration of this problem has led your committee to recommend that the State of California should never enter into another land settlement scheme."

The land settlement work of the state originally was administered by a Land Settlement Board of five members appointed by the Governor,

the chairman of which board was the salaried and chief administrator. A colony superintendent with office and field force was maintained at each of the two settlements. In 1921 the project was made a division of the Department of Public Works, the Land Settlement Board being retained in an advisory capacity only. This division was discontinued in 1923 when legislation calculated to restore the original scheme of a Land Settlement Board in full charge was enacted. This legislation, however, was found to be ambiguous and of doubtful effect, nevertheless the land settlements were operated as if the board were fully restored, until in 1925 legislation was enacted effectively restoring it. This situation continued until the act of 1927, referred to, created a Division of Land Settlement in the Department of Agriculture and transferred to the department the functions, powers, duties and funds of the Land Settlement Board, but retained the Land Settlement Board, to be composed of three members, the Director of Agriculture (chairman), Director of Finance, and State Engineer, and reserved to it such functions as previously it had exercised as a body corporate.

From the creation of the first Land Settlement Board in 1917 throughout the establishment of the colonies at Durham and Delhi and until March, 1923, the entire project of land settlement was under the general supervision of Dr. Elwood Mead as the administrative head. No successor was appointed till January, 1924. From January, 1924, till July 29, 1927, C. M. Wooster was chairman of the board and chief administrator of the colonies.

When taken over on July 29, 1927, by the Department of Agriculture, *the responsibility amounted to a virtual receivership*, involving 14,600 acres of land, 390 settlers and their families and an investment of some $3,000,000 on the part of the state. The Delhi Settlement was operating under an increasing deficit, even under the revised program instituted in 1925 when a large amount was written off by the state as a loss to give the settlers and the settlement a new start. The Durham Settlement, while in much better shape, was faced with a diminishing book reserve account.

The condition of the Delhi Settlement is little if any more hopeful under the adjustment of 1925 than it was reported to have been in July, 1923, in the following language taken from the report of Chairman C. M. Wooster to Governor Friend W. Richardson under date of December 31, 1925:

"In July, 1923, the Delhi Settlement reached a state of desperation. Income from the farms would not supply the necessities of life and besides there were taxes, water charges and interest on Federal Bank loans. Resources of the settlers were exhausted. No installment payments had been made on 95 per cent of the purchase agreements and they had been forfeitable for more than three years. The Settlement being remote from industrial activities, no outside work was obtainable, and with buildings, had cost the settlers $400 an acre. Necessary improvement in the way of fruit, vines, dairy and poultry equipment has increased and will continue to increase the price beyond the probability of adequate return. Such consideration, coupled with the past three years of pioneering work devoted to the conversion of the undulating sand plane into plantations of alfalfa, fruit and vine farms, had exhausted both the physical and financial resources of the settlers."

Also in the report of the auditor of the Department of Finance, reporting on Delhi as of June 30, 1927, appears the following:

"Notwithstanding the legislative relief afforded this colony, conditions have not improved to any extent. There has been an actual loss on operations in the last two years of $25,354.38 and there is no immediate prospect of wiping out the deficit of $25,927.54 now on the books. Unsold land is the main problem. It constitutes 45 per cent of the entire acreage, and half of it brings in no return whatever—notwithstanding all efforts and an advertising expenditure of $1200 during the period under audit, the unsold land was on June 30, 1927, more by 52 acres, than on September 30, 1925. The delinquencies are piling up and there is a lot of dissatisfaction and discouragement."

At Delhi on August 1, 1927, there was a delinquency of $58,800 on amounts due from settlers on installments falling due since the adjustment of July 24, 1925. This delinquency amounted to 37.62 per cent of the total amount of $156,300 which had fallen due during that time. The following statement shows the measure of delinquency in terms of settlers:

DELHI DELINQUENCIES

		Per cent
Persons holding farm property June 30, 1927	242	
3	paid in full at time of purchase	1.24
4	paid in full after starting on regular contracts	1.65
3	had their property revert to the state with privilege of redeeming within one year of such reversion	1.24
232	are still operating under the term contract	95.87
Status of contract payments which have fallen due from July 24, 1925, to and including June 30, 1927, as of August 31, 1927, on 232 contracts:		
76	have made all payments in full	32.7
73	owe all or part of June 30, 1927, payments	31.5
47	owe all or part of two installment payments from December 31, 1926	20.3
31	owe all or part of three installment payments from June 30, 1926	12.9
4	have traded their property to the state for other property and have had delinquencies taken care of by equity in former allotment	1.7
2	did not execute revised contracts and will be foreclosed	.9

It is important to remember that these figures refer to settlers all of whom were clear of delinquency on July 24, 1925, and who were operating under an especially favorable contract involving payment of only 1 per cent interest and 1 per cent principal payment per annum on land, which land principal represents two-thirds the total obligation, the balance being improvement principal on which 5 per cent interest and 3 per cent annual principal payment is required. These payments will be increased after July 1, 1930, by 4 per cent per annum on deferred amount owing on land or by about $30,000 per year.

A financial statement as of August 1, 1927, showed a deficit of $30,161.88 with a valuation on fixed assets much above the actual value.

FINANCIAL STATEMENT, DELHI STATE LAND SETTLEMENT, AUGUST 1, 1927

Assets

Available funds			$69,025 33
Appropriated funds 205–25	$67,025 33		
Contingent fund (Peoples Bank, Turlock)	2,000 00		
Due on settlers contracts			45,817 52
Land payments	$12,202 69		
Improvements	32,158 01		
Special contracts	1,456 82		
Miscellaneous accounts receivable—			
From settlers		$9,769 25	
From other than settlers		3,581 89	
			13,351 14
Rentals due			3,606 71
Durham State Land Settlement			11,215 23
Total current assets			$143,015 93
Deferred balances owing on settlers' contracts			$1,275,641 21
On Land	$819,620 76		
On improvements	488,092 08		
On special contracts	7,928 37		
United Concrete Pipe and Construction Company			2,986 50
Abeyance account			40,560 92
Unsold land			712,187 90
Unsold improvements			197,860 06
Stores			17,984 99
Equipment	$8,172 32		
Less depreciation reserve	4,740 01		
			3,432 31
Federal Land Bank of Berkeley, capital stock, bonds, etc.			15,755 00
Trust fund			432 91
			$2,409,857 73
Deficit			30,161 88
			$2,440,019 61

Liabilities

State of California, liability for expended funds			$2,070,162 24
Chapter 450–19	$875,519 48		
Chapter 15–21	250,000 00		
Chapter 734–21	750,000 00		
Chapter 205–25	182,974 67		
Accrued interest, 205–25	11,668 09		
State of California, unexpended funds 205–25			67,025 33
Federal Land Bank of Berkeley			300,140 98
Option account			238 00
Funds in trust			432 91
Irrigation maintenance sinking fund			2,020 15
General	$1,887 74		
River farms	132 41		
			$2,440,019 61

At Durham the delinquency on settlers' accounts on August 1, 1927, was $104,000, extending back over a period of six years and more, some $4,000 of it having been delinquent prior to 1921. The following statement shows the Durham delinquencies as of August 1, 1927, in terms of settlers:

DURHAM LAND SETTLEMENT, AUGUST 1, 1927

Resume—Land Contracts

		Per cent
26	paid-up contracts	16.2
51	land contracts not delinquent	32.0
20	one installment (June 30, 1927) or less delinquent	12.5
9	contracts, two installments or more than one installment	5.6
54	more than two installments or more than one year delinquent	33.7
160		100.0

Resume—Notes and Improvement Contracts

		Per cent
37	which are not delinquent	37.7
35	delinquent one or less installments	35.7
16	are more than one installment but not more than two	16.4
10	are more than one year delinquent	10.2
98		100.0

It is important to note, relative to the amount and distribution of Durham delinquencies, that they cover the entire period of operation from 1918 to August 1, 1927, and that that period embraced the hump of immediate post-war market conditions and overstimulation as well as the deflation and depression of the past few years and therefore may be taken as a fair demonstration of state land settlement activity. The experiment, however, is not yet completed.

A financial statement at Durham as of August 1, 1927, showed a book reserve of $83,916.39, which previous records indicate is rapidly diminishing and fixed assets which doubtless would be impossible to realize on at the listed value.

STATEMENT OF CONDITION OF THE DURHAM STATE LAND SETTLEMENT AS OF AUGUST 1, 1927

Assets

Available funds		$28,612 79
Fund 755–17	$19,221 05	
Cash, commercial	8,391 74	
Revolving fund	1,000 00	
Payments due		104,020 05
Land contracts	$95,428 71	
Improvements	1,199 03	
Notes receivable	5,597 97	
Miscellaneous accounts receivable	1,683 74	
Lease contracts	110 60	
Warrants receivable		429 56
		$133,062 40
Deferred balances		470,263 47
Land contracts	$387,817 71	
Improvements	20,628 62	
Notes receivable	59,483 14	
Lease contracts	2,334 00	
Stores	$566 32	
Equipment	2,009 75	
		2,576 07
Unsold lands	$74,570 70	
Improvements on same	11,787 20	
		86,357 90
Reserved lands	$11,290 32	
Improvements on same	8,815 30	
		20,105 62
Trust Fund Bank of Durham	$2,334 50	
Unclaimed trust moneys	6 14	
Pending first mortgage	1,572 60	
Doubtful accounts	691 49	
		4,604 73
Total assets		$716,970 19

Liabilities

Claims payable		$429 56
Stanford University contract deferred	$230,738 76	
Advance payments on same	26,520 29	
		204,218 47
State of California—expended loans—		
Fund 755–17	$230,778 95	
Fund 450–19	124,480 52	
		355,259 47
State of California—unexpended loans (Fund 755–17)		19,221 05
Accrued interest to State of California		31,456 77
Federal Land Bank mortgage		6,578 61
Liability for special deposits		2,334 50
Reserve for lease contracts		2,334 00
Delhi Settlement		11,215 23
Liability for canceled checks		6 14
Total liabilities		$633,053 80
Surplus (if unsold lands shall be sold at scheduled prices)		83,916 39
Total surplus and liabilities		$716,970 19

In August, 1927, at the request of Governor C. C. Young, a committee of citizens inspected the colonies at both Delhi and Durham and reported to the Governor respecting conditions at the colonies.

This committee was made up as follows: J. M. Inman, Sacramento, State Senator (chairman); Chas. H. Deuel, Chico, State Assemblyman; Earl Houghton, Porterville, President California Farm Bureau Federation; Geo. C. Harrison, Sebastopol, Master State Grange; R. V. Garrod, Los Gatos, President Farmers' Union; John R. Pickett, San Francisco, editor and publisher Pacific Rural Press; C. C. Teague, Santa Paula, Chairman Agricultural Legislative Committee; H. C. Carr, San Francisco, Vice President and Manager, Public Relations Department Bank of Italy.

The low price of canning peaches in 1927, of which there is a large acreage in Delhi, has seriously affected the settlers' ability to meet their obligations. Grapes also did not bring the returns anticipated. Alfalfa had failed to produce sufficiently to sustain the extensive dairy operations and annual crops such as blackeye beans were of low market value and production was light. Plant diseases had developed to an unexpected extent. As a result collections during the five months period under consideration and particularly at the semiannual payment date in December, 1927, were very low. For these reasons, an attitude of leniency in the matter of payments was adopted by the Division and the period of grace on delinquent payments was extended where evidence was presented indicating the inability of the settler to meet his payments.

At Durham the collections for the period from August 1, 1927, to December 31, 1927, also have been very much below those of 1926 for the same time, due, also in some measure to the general agricultural depression, poor markets and the failure of alfalfa to produce as it should. (The failure of alfalfa to produce satisfactorily over a period of years has been noted throughout many parts of the state, however, and though acute in the state land settlement colonies, is by no means confined to them.) In Durham there has been adopted a custom of ten-day-interest-free-extension beyond payment date and the payments that came in during those first ten days of January, 1928, greatly augmented the December payments. The same attitude of leniency toward the delinquents who are honestly trying to meet their obligations was taken here as in Delhi.

The conditions at Durham are very much more hopeful than at Delhi but there exists among a considerable number of settlers at Durham a spirit of dissatisfaction and rebellion against the established order of things. As a result of this some 16 of the 140 settlers have served notice of rescission of contract of purchase or deed. These rescission notices are, it is understood, to establish foundation for damage suits or suits to cancel contract on the part of the settlers. Those filing rescission notices make three allegations as follows:

"1. That the consent of the rescinding party was given by mistake.

2. That the consent of the rescinding party was obtained through fraud, exercised by or with the connivance of the state.

3. That through the fault of the state, the consideration for the obligation of the purchaser in said contract contained, has failed in part."

The propriety, however, of these allegations is questioned by other settlers.

Outside of this more concerted movement some individual settlers have filed suits for damages because of special injury alleged to have been suffered and in order to better protect the interest of the state in meeting the issues of litigation involved and arising by reason of the action of these settlers, special local counsel has been retained to collaborate with the office of the Attorney General. The firm of Bond and Deirup of Chico is retained as such counsel.

The interest of the state must be protected while at the same time absolute fairness to the settlers must obtain. Unjust claims and demands must be resisted, but the full measure of obligation on the part of the state to the settlers must be met.

At Durham, the Division in conjunction with the Durham State Land Settlement Water Users' Committee is carrying on work of repairing portions of the irrigation system by concrete lining to prevent loss of water and seepage injurious to crops.

Special investigation and observation of drainage conditions also are under way in preparation for the installation of an adequate drainage system, as well as a general investigation of conditions to determine whether or not the demands of settlers for adjustment in contracts of purchase are reasonable and justified.

The delinquency on settlers accounts owing as of December 31, 1927, at Delhi is $67,630.76 of the $194,400 which has fallen due since July 24, 1925, or 36 per cent. At Durham the delinquency as of December 31, 1927, is $120,389.09 covering the entire period of operation, about ten years, and represents a delinquency of about 21 per cent.

General statistical and financial reports of interest other than those previously included follow:

STATEMENT OF ACREAGE, COST AND SELLING PRICE

Delhi

	Acreage	*Cost per acre*	*Amount*
Alladin Rancho	2,607.3100	$92 50	$241,176 17
Geo. H. Lettean	198.6000	115 00	13,708 50
Nella E. Orendorff	105.4500	130 00	22,875 00
Mollie E. Wilson	100.0000	115 00	18,000 00
Victorin Park Co.	40.0400	115 00	4,604 60
L. W. Lenk	9.0000	233 33	2,100 00
Edgar M. Wilson	5,046.4950	92 50	466,800 78
Edgar M. Wilson	114.3690	130 23	14,794 66
Edgar M. Wilson	79.8940	100 00	7,989 40
Edgar M. Wilson	39.6600	134 63	5,339 48
Title fees			413 57
Improvements sold as land			3,701 92
Additions to cost of land		95 12	793,979 60
Total	8,400.8180		
Acreage short in survey	52.8698		
Net total	8,347.9482	$191 12	$1,595,483 68
Sold on contract	4,478.161	$192 59	$862,476 26
Paid up contracts	11.80	210 04	2,478 50
Poor land sold outright	63.64	44 23	2,815 05
Townsite property sold outright	3.8342	1,982 16	7,600 00
Townsite property donated	13.83		
Unsold acreage	3,776.683	190 67	720,113 78
	8,347.9482	$191 12	$1,595,483 59

STATEMENT OF ACREAGE, COST AND SELLING PRICE

Durham

	Acreage	*Cost per acre*	*Amount*
Stanford University	3,882.45	$90 02	$349,499 00
Chas. F. Lott Estate	2,348.34	65 04	152,735 00
L. M. Compton	8.51	15 00	127 65
Overage in survey	.28	-------	----------
Additions to cost of land	-------	47 11	293.933 85
Total acquisition	6,239.58	$127 62	$796,295 50
Sold on contract	4,416.90	$149 78	$661,564 44
Sold for cash and paid up contracts	235.08	207 88	48,870 04
Reserved	809.20	13 95	11,290 32
Unsold	778.30	95 80	74,570 70
Total disposition	6,239.48	$127 62	$796,295 50

STATUS OF INVESTMENT OF STATE OF CALIFORNIA IN LAND SETTLEMENT EXCLUSIVE OF INTEREST CHARGES AS OF JUNE 30, 1927

	State of California—expenditures	*Not recoverable*
Appropriations: Chapter 755-17	$260,000 00	$10,000 00
Chapter 450-19	1,000,000 00	----------
Chapter 15-21	250,000 00	----------
Chapter 734-21	750,000 00	----------
Chapter 205-25	250,000 00	----------
Chapter 302-25	350,000 00	350,000 00
Totals	$2,860,000 00	$360,000 00

NOTE.—Chapter 302, Statutes 1925, $350,000 was an appropriation to absorb interest due—merely a book appropriation.

	Appropriated funds due from Durham	*Delhi*
Appropriations: Chapter 755-17	$229,076 52	----------
Chapter 450-19	124,480 52	$875,519 48
Chapter 14-21	----------	250,000 00
Chapter 734-21	----------	750,000 00
Chapter 205-25	----------	181,968 93
Balance in Land Settlement fund	20,923 48	68,031 07
Totals	$374,480 52	$2,125,519 48

NOTE.—Land Settlement reports were published in 1918-1920-1922. These reports give details as to selection of settlers and plans of operation and administration.

CALIFORNIA CROP REPORT FOR 1927

E. E. KAUFMAN, Agricultural Statistician

The total production of California field, fruit and vegetable crops exceeded the forecasts and preliminary estimates reflected in the early season reports. As the index of farm prices improved slightly as the season advanced the total returns to the growers of these crops were greater than anticipated.

The annual crop survey of California for 1927 shows a total value of all main field, fruit and vegetable crops of $474,840,000. This compares with a like estimate of the 1926 crops of $464,982,000. An estimated valuation of all crops in the various states gives California in 1927 the rank of third place. In 1925, and also in 1926, California ranked second in the estimated valuation of all crops in the various states. Of the main field and fruit crops alone 11,703,700 tons were harvested in 1927 compared to 11,787,000 tons in 1926. An increase in acreage of the main field crops also produced an increase in total tonnage, while an increase in the bearing acreage of fruit crops produced nearly 300,000 tons less fruit in 1927 than the previous year. In this connection, however, there was a probable production of over 200,000 tons which were not harvested and therefore not estimated in the total tonnage produced the past year. The average value per ton in 1927 of the main field crops was 48 cents greater than the average value per ton for the previous year, while the average value per ton of the fruit crops harvested in 1927 was $4.21 greater than in 1926. An increase of about 29,000 acres planted to vegetable crops in 1927 increased the total valuation of such crops $1,276,000 more than the value of such crops the previous year.

This report revises the preliminary summary released early in 1928 on the production of California field, fruit and vegetable crops for 1927 and in tabular form briefly tells the story of California crop production for the past year in comparison with the four previous years. Other production reports released during the year were but forecasts based on preliminary estimates of acreages and prevailing crop conditions during the growing season. Embodied in this report are the final estimates for the year of all main crops, except live stock and live stock products. The estimates here recorded for 1926 have been revised in accordance with final data now available on acreage and production. The 1927 estimates are subject to a similar revision one year hence.

The valuation of all crops is based on the average price to the grower prevailing on December 1 or on an average price during the harvest season, delivered at the home-town market, shipping station or packing shed.

To compare total production of all crops one year with another it is necessary to reduce all crops to a common measure. Unless otherwise indicated, production is recorded in tons.

In Table 1 are given estimates of the acreage, production in tons and farm value to the grower of the main field crops; the bearing acreage, estimated tonnage and value of the main fruit crops; and the estimated acreage and value only of the vegetable crops produced during the past five years.

TABLE 1—*Acreage, Production and Value of California Crops*

Year	Acreage	Production (tons)	Average value per ton	Farm value December 1
FIELD CROPS				
1927	4,666,000	7,767,700	$21 37	$165,967,000
1926	4,633,400	7,575,600	20 89	158,277,000
1925	4,546,000	8,053,709	23 81	191,785,000
1924	4,049,000	6,725,872	27 79	186,903,000
1923	5,098,000	8,176,469	22 32	182,505,000
5-year average (1923-27)	4,598,480	7,659,870	23 12	177,087,400
FRUIT CROPS				
1927	1,670,557	3,936,000	61 04	240,265,000
1926	1,600,787	4,212,000	56 83	239,373,000
1925	1,493,828	3,723,000	58 80	218,899,000
1924	1,364,483	3,016,000	67 93	204,869,000
1923	1,249,109	3,652,000	45 60	166,526,000
5-year average (1923-27)	1,475,753	3,708,000	57 72	213,986,000
VEGETABLE CROPS				
1927	355,940			68,608,000
1926	327,090			67,332,000
1925	268,150			59,574,000
1924	233,975			48,898,000
1923	213,950			62,668,000
5-year average (1923-27)	279,821			61,416,000

SEASONAL CONDITIONS

A varied assortment of weather conditions prevailed throughout the year. Rainfall was normal or better throughout the state. The snowfall on watersheds of streams supplying gravity irrigation water to California farms was sufficient to provide an ample water supply throughout the season.

Slightly below normal temperatures generally prevailed during the early months, with a consequent backward season and a delayed harvest of from one to two weeks. Light to heavy frosts occurred in scattered localities the first half of April, causing slight injury to various crops in widely separated areas. No serious injury occurred to any crops from late spring frosts. October, 1927, was reported by the Weather Bureau as the warmest October for a number of years. It was an ideal harvest month for those crops ripening during the fall months. Rain the last few days of October continued intermittently during November, holding up the rice harvest and delaying the picking and ginning of cotton.

The character of the recent crop seasons in California is indicated in Table 2 which shows the composite condition of all important crops during months of the growing period, in which 100 represents an average (not normal) condition.

TABLE 2—*Monthly Composite Crop Conditions, 1915-1927*

	June 1	July 1	August 1	September 1	October 1
1915	112.8	106.7	103.8	101.7	103.5
1916	92.0	95.2	96.4	99.8	101.2
1917	104.5	100.3	97.7	97.6	101.3
1918	98.0	94.2	92.6	89.0	86.5
1919	105.0	101.8	98.0	98.9	100.5
1920	95.8	95.4	96.8	96.5	95.7
1921	96.5	95.0	94.8	95.1	94.7
1922	98.9	100.4	101.7	102.3	101.2
1923	105.9	106.1	106.3	105.7	109.5
1924	87.1	87.2	87.9	85.0	89.4
1925	102.9	103.7	100.5	97.1	107.8
1926	103.1	102.1	102.3	103.7	108.0
1927	96.7	98.4	98.4	103.4	106.7

WAGES OF FARM LABOR

But little change was noted in the wages paid for farm labor in 1927 as compared with the previous year. In view of the statewide interest in the question of farm labor there are shown in Table 3 the average wages paid per day for hired farm labor, without board and with board, at times other than harvest, for California; the eleven western states including California; the United States including California; and a percentage comparison of California farm wages and those of the United States.

TABLE 3—*Wages of Farm Labor—Average per Day, Other Than Harvest Time*

	Without board				With board			
	California	Eleven western states	United States	California compared with U. S., per cent	California	Eleven western states	United States	California compared with U. S., per cent
1927*	$3 60	$3 29	$2 44	148	$2 70	$2 48	$1 89	143
1926*	3 65	3 35	2 46	147	2 65	2 53	1 91	139
1925*	3 60	3 25	2 44	148	2 70	2 49	1 89	143
1924*	3 40	3 16	2 43	140	2 40	2 33	1 87	128
1923*	4 00	3 47	2 45	163	3 12	2 60	1 84	170
1922	3 40	3 00	2 15	158	2 53	2 23	1 65	153
1921	3 35	3 01	2 22	151	2 55	2 26	1 68	152
1920	4 60	4 61	3 59	128	3 60	3 66	2 86	126
1919	3 90	4 02	3 12	125	2 99	3 08	2 45	122
1918	3 25	3 52	2 63	124	2 60	2 76	2 07	126
1917	2 67	2 82	2 02	132	2 04	1 87	1 56	131
1916	2 17	2 24	1 62	134	1 57	1 67	1 26	125
1915	2 10	2 08	1 47	143	1 55	1 54	1 13	137
1914	2 05	2 09	1 45	141	1 44	1 52	1 13	127
1913	2 01	2 07	1 50	134	1 44	1 52	1 16	124
1912	2 03	2 06	1 47	138	1 48	1 54	1 14	130
1911	2 05	2 07	1 42	144	1 48	1 51	1 09	136
1910	2 02	2 06	1 38	146	1 44	1 51	1 06	136

*Data for July 1.

FIELD CROPS

The latest revised estimates of acreage, production and farm value relating to the main field crops of California for the years 1923 to 1927, inclusive, and the 5-year average, are shown in Table 5. In other tables and the discussion that follows are given more details and additional information.

Corn, Indian—The San Joaquin River Delta continues to be the most important corn producing area of the state. The total acreage of corn in California in 1927 was 77,000. Of this total, 40,000 acres were for the production of grain, while 37,000 acres were grown for silage and other forage purposes. Total production figures recorded in Table 5 are based on the assumption that the grain yield per acre on acreage grown for silage and forage would be the same as from the acreage grown for grain. The actual production of corn for grain was therefore only about 1,287,000 bushels as compared with 1,304,000 bushels produced in 1926.

Wheat, Barley and Oats—The acreage of wheat harvested in 1927 was greater than in 1926, but the average yield per acre was not quite so good. The acreage of barley and oats harvested in 1927 was slightly less than for the previous year with a smaller yield per acre and therefore a consequent decrease in total production for botl· barley and oats. Total acreages of small grains harvested each year in California are not only dependent on seedings, but also on weather conditions that prevail during autumn, winter and spring. In various localities and for the state as a whole the planted acreage each year is disposed of in three ways, namely: harvested for grain, harvested for hay and abandoned for either grain or hay harvest. In Table 4 are shown estimates of the total planted and harvested acreages of wheat, barley and oats in California for the past four years, and also grain production recorded in tons. The small acreages harvested for grain in 1924 of wheat, barley and oats were due to the severe drought that prevailed throughout the year. These estimates relate to the entire production of these grains in the state, including the grain that is consumed as feed or seed in the territory where grown, as well as that portion that enters main trade channels.

TABLE 4—*Estimated Acreage Wheat, Barley and Oats in California, 1924-1927*

	1924	1925	1926	1927
Wheat—				
Total acreage planted	782,000	804,000	812,000	923,000
Acreage harvested for grain	377,000	603,000	653,000	812,000
Acreage harvested for hay	168,000	99,000	100,000	84,000
Abandoned acreage	237,000	102,000	59,000	27,000
Total grain production in tons	169,667	343,744	360,486	409,300
Barley—				
Total acreage planted	1,220,000	1,435,000	1,384,000	1,223,000
Acreage harvested for grain	765,000	1,050,000	1,080,000	994,000
Acreage harvested for hay	374,000	334,000	271,000	192,000
Abandoned acreage	90,000	51,000	33,000	37,000
Total grain production in tons	402,160	781,325	777,724	656,100
Oats—				
Total acreage planted	449,000	400,000	376,000	387,000
Acreage harvested for grain	86,000	151,000	156,000	147,000
Acreage harvested for hay	350,000	241,000	218,000	228,000
Abandoned acreage	13,000	8,000	2,000	12,000
Total grain production in tons	25,040	83,840	81,120	67,000

TABLE 5—*Acreage, Production and Value of Specified Field Crops, 1923-1927*

Crop		Acreage	Production			Farm value, Dec. 1	
			Per acre	Total	Unit	Per unit	Total
Corn	1927	77,000	32.00	2,464,000	Bushels	$1 08	$2,661,000
	1926	77,000	31.50	2,426,000	Bushels	1 06	2,572,000
	1925	81,000	35.10	2,843,000	Bushels	1 18	3,355,000
	1924	82,000	33.50	2,747,000	Bushels	1 38	3,791,000
	1923	128,000	35.00	4,480,000	Bushels	1 08	4,838,000
5-year average (1923-27)		89,000	33.62	2,992,000	Bushels	$1 15	$3,443,400
Wheat	1927	812,000	16.80	13,642,000	Bushels	$1 18	$16,098,000
	1926	653,000	18.40	12,015,000	Bushels	1 30	15,620,000
	1925	603,000	19.00	11,457,000	Bushels	1 48	16,956,000
	1924	377,000	15.00	5,655,000	Bushels	1 54	8,709,000
	1923	748,000	21.60	16,157,000	Bushels	1 08	17,450,000
5-year average (1923-27)		638,600	18.45	11,785,200	Bushels	$1 27	$14,966,600
Oats	1927	147,000	28.50	4,190,000	Bushels	$0 63	$2,640,000
	1926	156,000	32.50	5,070,000	Bushels	0 48	2,434,000
	1925	151,000	34.70	5,240,000	Bushels	0 61	3,196,000
	1924	86,000	18.20	1,565,000	Bushels	0 87	1,362,000
	1923	162,000	32.50	5,265,000	Bushels	0 60	3,159,000
5-year average (1923-27)		140,400	30.38	4,266,000	Bushels	$0 60	$2,558,200
Barley	1927	994,000	27.50	27,335,000	Bushels	$0 93	$25,422,000
	1926	1,080,000	30.00	32,400,000	Bushels	0 58	18,792,000
	1925	1,050,000	31.00	32,550,000	Bushels	0 75	24,412,000
	1924	765,000	21 90	16,754,000	Bushels	1 16	19,435,000
	1923	1,095,000	30.20	33,069,000	Bushels	0 70	23,148,000
5-year average (1923-27)		996,800	28.51	28,421,600	Bushels	$0 78	$22,241,800
Rice	1927	160,000	56.00	8,960,000	Bushels	$1 15	$10,304,000
	1926	149,000	53.60	7,986,000	Bushels	1 31	10,462,000
	1925	103,000	46.60	4,800,000	Bushels	1 70	8,160,000
	1924	90,000	48.50	4,365,000	Bushels	1 66	7,246,000
	1923	106,000	53.50	5,671,000	Bushels	1 12	6,352,000
5-year average (1923-27)		121,600	52.27	6,356,400	Bushels	$1 34	$8,504,800
Grain sorghum	1927	130,000	31.20	4,056,000	Bushels	$0 97	$3,934,000
	1926	96,000	32.00	3,072,000	Bushels	0 84	2,580,000
	1925	88,000	34.00	2,992,000	Bushels	1 07	3,201,000
	1924	84,000	30.50	2,562,000	Bushels	1 35	3,459,000
	1923	135,000	33.00	4,455,000	Bushels	1 00	4,455,000
5-year average (1923-27)		106,600	32 15	3,427,400	Bushels	$1 03	$3,525,800
Beans	1927	296,000	16 30	4,825,000	Bushels	$2 70	$13,028,000
	1926	305,000	18.80	5,734,000	Bushels	3 00	17,202,000
	1925	240,000	19.00	4,560,000	Bushels	4 10	18,696,000
	1924	206,000	13.10	2,699,000	Bushels	5 20	14,035,000
	1923	299,000	15.70	4,694,000	Bushels	4 00	18,776,000
5-year average (1923-27)		269,200	16.73	4,502,400	Bushels	3 63	16,347,400
Hay (tame)	1927	1,649,000	3.13	5,156,000	Tons	$12 50	$64,450,000
	1926	1,699,000	2.93	4,984,000	Tons	12 30	61,303,000
	1925	1,777,000	3.05	5,417,000	Tons	14 00	75,838,000
	1924	1,974,000	2 35	4,642,000	Tons	21 70	100,731,000
	1923	2,066,000	2.55	5,268,000	Tons	14 00	73,752,000
5-year average (1923-27)		1,833,000	2.78	5,093,400	Tons	$14 77	$75,214,800

TABLE 5—*Acreage, Production and Value of Specified Field Crops, 1923-1927*—Continued

Crop		Acreage	Production			Farm value, Dec. 1	
			Per acre	Total	Unit	Per unit	Total
Hay (wild)	1927	147,000	1.20	176,000	Tons	$8 50	$1,496,000
	1926	150,000	1.10	165,000	Tons	7 50	1,238,000
	1925	148,000	1.40	207,000	Tons	8 50	1,760,000
	1924	114,000	0.74	84,000	Tons	17 00	1,428,000
	1923	152,000	1.00	152,000	Tons	10 00	1,520,000
5-year average (1923-27)		142,200	1.10	156,800	Tons	$9 49	$1,488,400
Potatoes	1927	52,000	153 00	7,956,000	Bushels	$0 95	$7,558,000
	1926	43,000	161.00	6,923,000	Bushels	1 32	9,138,000
	1925	43,000	159.00	6,837,000	Bushels	2 00	13,674,000
	1924	46,000	162.00	7,452,000	Bushels	0 90	6,707,000
	1923	52,000	150.00	7,800,000	Bushels	1 12	8,736,000
5-year average (1923-27)		47,200	156.64	7,393,600	Bushels	$1 24	$9,162,600
Sweet Potatoes	1927	12,000	90.00	1,080,000	Bushels	$1 15	$1,242,000
	1926	12,000	97.00	1,164,000	Bushels	1 10	1,280,000
	1925	9,000	112.00	1,008,000	Bushels	1 70	1,714,000
	1924	6,000	94.00	564,000	Bushels	2 18	1,230,000
	1923	6,000	115.00	690,000	Bushels	1 65	1,139,000
5-year average (1923-27)		9,000	100.13	901,200	Bushels	$1 47	$1,321,000
Sugar Beets	1927	56,000	8.00	449,000	Tons	[1]$9 00	$4,041,000
	1926	46,000	8.00	369,000	Tons	9 25	3,413,000
	1925	76,000	6.45	490,000	Tons	8 21	4,023,000
	1924	84,000	9.35	785,000	Tons	9 14	7,175,000
	1923	61,000	9.59	585,000	Tons	13.99	8,184,000
5-year average (1923-27)		64,600	8.29	535,600	Tons	$10 02	$5,367,200
Hops	1927	6,000	1650.00	9,900,000	Pounds	$0 20	$1,980,000
	1926	5,400	1650.00	8,910,000	Pounds	0 21	1,871,000
	1925	5,000	1600.00	8,000,000	Pounds	0 20	1,600,000
	1924	6,000	1600.00	9,600,000	Pounds	0 11	1,056,000
	1923	5,000	1480.00	7,400,000	Pounds	0 18	1,332,000
5-year average (1923-27)		5,480	1598.90	8,762,000	Pounds	0 18	1,567,800
Cotton (lint)[2]	1927	128,000	340 00	43,547,000	Pounds	$0 21	$9,145,000
	1926	162,000	386 00	62,422,000	Pounds	0 14	8,739,000
	1925	172,000	339.00	58,218,000	Pounds	0 22	12,808,000
	1924	129,000	287.00	37,035,000	Pounds	0 24	8,888,000
	1923	83,000	313.00	25,990,000	Pounds	0 32	8,317,000
5-year average (1923-27)		134,800	337.10	45,442,400	Pounds	$0 21	$9,579,400
Cotton seed[2]	1927	.....	.....	43,500	Tons	$37 50	$1,631,000
	1926	.....	.....	62,400	Tons	19 50	1,217,000
	1925	.....	.....	58,200	Tons	29 50	1,717,000
	1924	.....	.....	37,000	Tons	29 00	1,073,000
	1923	.....	.....	26,000	Tons	38 00	988,000
5-year average (1923-27)		.....	.....	45,420	Tons	$29 18	$1,325,200
Alfalfa seed	1927	[3]13,300	3.50	36,600	Bushels	$9 20	$337,000
	1926	[3]14,400	2.75	39,600	Bushels	10 50	416,000
	1925	[3]16,000	3.70	59,200	Bushels	11 40	675,000
	1924	[3]13,500	4 20	56,700	Bushels	10 20	578,000
	1923	[3]11,000	3.40	37,400	Bushels	9 60	359,000
5-year average (1923-27)		13,640	3.37	45,900	Bushels	$10 31	$473,000

[1] Subject to revision, as final price to grower not fully determined at this date.
[2] Does not include estimate of 110,000 acres and 45,000 bales grown in Lower California, Mexico.
[3] Included in all tame hay acreage.

Beans—The large crop of beans produced in 1926 resulted in a slightly reduced acreage for the 1927 crop. This, coupled with a slight decrease in yield per acre compared with the previous year, caused a decrease in total production although the crop was the second largest grown since 1922.

Table 6 shows the estimated acreage of all beans and the production in 100-pound bags segregated by varieties of California beans from 1922 to 1927, inclusive.

TABLE 6—*Estimated Bean Production by Varieties, in 100-pound Bags, 1922-1927*

	1922	1923	1924	1925	1926	1927
Limas	1,328,000	830,000	480,000	800,000	1,250,000	1,010,000
Baby limas	150,000	220,000	225,000	300,000	580,000	310,000
Small whites	325,000	360,000	77,000	200,000	180,000	280,000
Large whites	110,000	100,000	40,000	25,000	15,000	15,000
Pinks	625,000	650,000	260,000	625,000	580,000	520,000
Blackeyes	275,000	275,000	277,000	450,000	450,000	300,000
Red kidneys	60,000	40,000	20,000	30,000	45,000	60,000
Cranberries	100,000	143,000	70,000	60,000	73,000	110,000
Mexican reds	75,000	60,000	60,000	132,000	80,000	125,000
Bayos	25,000	30,000	20,000	15,000	21,000	25,000
Miscellaneous	27,000	33,000	40,000	30,000	40,000	50,000
Total production	3,100,000	2,741,000	1,569,000	2,667,000	3,314,000	2,805,000
Harvested acreage	324,000	299,000	206,000	240,000	305,000	296,000

Hay—Statistical information relative to the California hay crops shown by types the past three years is recorded in Table 7. Nearly all of the alfalfa in California is grown by irrigation and had an ample supply of water in 1927. The harvested acreage of grain hay in 1927 decreased by 70,000 acres in comparison with the previous year. A high average yield per acre usually curtails the acreage of grain hay. The estimates in this report relative to grain hay are separate and exclusive of all acreage and production data relating to wheat, barley and oats for grain.

TABLE 7—*California Hay by Types: Estimated Acreage and Production. (000 omitted)*

Type	Acreage (thousands of acres)			Yield per acre in tons			Production (thousands of tons)		
	1925	1926	1927	1925	1926	1927	1925	1926	1927
Alfalfa	971	981	1,001	4.20	4.00	4.20	4,078	3,924	4,204
Grain hay	694	616	546	1.60	1.40	1.40	1,110	862	764
Clover	8	8	8	1.65	1.60	1.50	13	13	12
Timothy	4	4	4	1.60	1.60	1.50	6	6	6
Mixed—clover and timothy	20	20	20	1.70	1.60	1.50	34	32	30
Millet, Sudan grass, etc.	80	70	70	2.20	2.10	2.00	176	147	140
Total—all tame hay	1,777	1,699	1,649	3.05	2.93	3.13	5,417	4,984	5,156
Wild hay	148	150	147	1.40	1.10	1.20	207	165	176
Total—all hay	1,925	1,849	1,796	2.92	2.78	2.97	5,624	5,149	5,332

Rice—The Sacramento Valley produced more than 95 per cent of the total rice crop of the state in 1927. The acreage planted and harvested, also the production, exceeded that of any year since 1920. Owing to a late spring a large percentage of the acreage was planted later than usual. The result was a later harvest than in 1926 and on account of rain throughout November about 6 per cent of the planted acreage was abandoned and the quality of the late-harvested rice injured to some extent.

Sugar Beets—The area of sugar beets harvested in 1926 amounted to about 46,000 acres which was the smallest harvested acreage of sugar beets in California since 1904. In 1927 there was an increase of about 10,000 acres in the area harvested with about the same average yield per acre as in the preceding year. The growing of sugar beets seems to be losing favor with the farmers of California. Curly Top disease caused severe loss in 1925 and the nematode is seriously affecting the production in some areas. Only five beet sugar factories operated in California in 1927.

The beet sugar production during recent years in California has been as follows: 1927, 76,000 tons; 1926, 68,000 tons; 1925, 88,000 tons; 1924, 131,000 tons; 1923, 100,000 tons and 1922, 73,000 tons.

Hops—About 6000 acres of hops were worked in California in 1927 compared with 5400 acres in 1926 and 5000 acres in 1925. In Table 5 is shown the acreage, production and value of the crop in California for the past few years. Oregon and Washington are the principal hop producing states aside from California. The area of hops harvested in Oregon in 1927 was 16,000 acres with an average yield per acre of only 940 pounds. In Washington the area harvested was 2600 acres with an average yield of 1867 pounds.

Other Miscellaneous Crops—In addition to the crops listed in Tables 5, 12 and 16, there are numerous other minor crops that contribute to the agricultural income of the state. Among these may be considered vegetable and flower seeds, mustard seed, sunflower seed, rye, broom corn, etc., as well as avocados, dates, pomegranates, persimmons, various small fruits and other miscellaneous crops. Nursery and greenhouse products are important income producers in various districts of the state and gradually increasing in value. In this report no attempt is made to give production or value of miscellaneous crops, nursery and greenhouse products.

Prices of Field Crops—In Table 11 is given the average price of the principal field crops received by producers in California for the years 1868 to 1927, inclusive. Source of data is the United States Department of Agriculture, Statistical Bulletin No. 17. Price data by months for recent years are to be found in the same bulletin.

Cotton—The cotton year of 1927 was not all that might be desired from a seasonal and production standpoint. Such deficiencies were largely offset, however, by prices received, which were about 50 per cent higher than the previous year. From 79 per cent as much acreage about 70 per cent as great a crop was harvested, which returned to the growers about 5 per cent more money than the larger crop of 1926.

It will be remembered that the 1926 season was distinctly favorable for good production, although selling prices were low. In 1926 there were harvested within the state 130,590 bales of cotton from 162,000

acres, or an average of 386 pounds per acre, which was much the largest average yield obtained in any state. The comparison of the 1927 crop to the previous season is therefore a contrast with one of the best production years that can be reasonably expected.

In reviewing the 1927 cotton season, it will be remembered that spring conditions were backward and considerable late replanting was necessary in all counties except Riverside and Imperial. The result was many imperfect stands and a late start. The summer months in most areas were quite favorable, excepting for a period of exceedingly hot, humid weather in the southern valleys which resulted in serious shedding of squares and small bolls. Killing frosts were not abnormally early, but in the San Joaquin and Sacramento valleys there followed rain and foggy weather which generally delayed maturity and opening. Late picking was therefore made difficult, resulting in more than the usual percentage of cotton of low grades. Ginning was considerably delayed during the early winter months, but had been completed by early spring. Cotton growers had sold most of the crop by April 15.

There was an ample supply of picking labor in most localities. No unusual damage from insect pests or diseases was recorded.

In Tables 8 and 9 are recorded acreage and production data for counties and valleys in California during recent years. Table 10 shows the production in California, United States and the World from 1910 to 1927.

TABLE 8—*Cotton Acreage and Production in California by Counties, 1925-1927*

County or valley	Acreage picked			Yield per acre pounds fiber			Production—bales (500 lbs. gross)		
	1925	1926	1927	1925	1926	1927	1925	1926	1927
Sacramento Valley	3,500	3,300	2,000	138	110	134	1,008	762	560
Stanislaus and San Joaquin counties	1,200	3,000	1,000	238	149	174	598	934	363
Merced County	5,400	9,300	5,000	167	278	236	1,887	5,405	2,464
Madera County	11,000	9,800	7,600	242	309	321	5,572	6,333	5,108
Fresno County	17,000	20,700	9,500	372	346	437	13,216	14,986	8,681
Kings County	12,000	11,200	9,000	421	509	382	10,579	11,933	7,193
Tulare County	17,200	22,300	18,900	439	510	437	15,808	23,803	17,284
Kern County	32,800	33,000	28,800	463	510	465	31,780	35,237	28,013
All San Joaquin Valley	96,600	109,300	79,800	393	431	414	79,440	98,631	69,106
Perris Valley	140	-------	-------	212	------	------	62	-------	-------
Coachella Valley	4,200	3,100	1,350	419	364	322	3,681	2,358	910
Palo Verde Valley	19,000	20,000	21,250	377	361	275	14,990	15,083	12,210
All Riverside County	23,340	23,100	22,600	384	361	278	18,733	17,441	13,120
Imperial Valley, California	40,800	20,400	18,800	202	204	130	17,235	8,704	5,099
Bard Valley	7,800	5,900	4,800	330	409	321	5,379	5,052	3,218
All Imperial County	48,600	26,300	23,600	222	250	169	22,614	13,756	8,317
California total	172,000	162,000	128,000	339	386	340	121,795	130,590	91,103
Imperial Valley (that part in Mexico)	150,000	130,000	110,000	255	317	194	80,071	86,285	44,611
Combined total	322,000	292,000	238,000	300	355	273	201,866	216,875	135,714

TABLE 9—*Acreage and Production of Cotton in California, 1919-1927*

Item and year	San Joaquin Valley	Riverside County	Imperial County	Total California	Imperial Valley (that part in Mexico)	Combined total
Acres picked:						
1919	5,500	19,500	60,000	85,000	100,000	185,000
1920	21,000	25,000	104,000	150,000	125,000	275,000
1921	3,500	14,000	37,500	55,000	85,000	140,000
1922	2,500	16,000	48,500	67,000	135,000	202,000
1923	9,000	21,200	52,800	83,000	150,000	233,000
1924	37,800	25,000	66,200	129,000	137,000	266,000
1925	96,600	23,340	48,600	[1]172,000	150,000	[1]322,000
1926	109,300	23,100	26,300	[2]162,000	130,000	[2]292,000
1927	79,800	22,600	23,600	[3]128,000	110,000	[3]238,000
Average yield per acre, pounds fiber:						
1919	242	389	222	262	258	260
1920	212	349	180	212	303	254
1921	245	357	175	226	280	259
1922	301	239	113	150	205	187
1923	488	388	253	313	276	289
1924	450	296	191	287	247	266
1925	393	384	222	[1]339	255	[1]300
1926	431	361	250	[2]386	317	[2]355
1927	414	278	160	[3]340	194	[3]273
Production, pounds fiber:						
1919	1,332,664	7,593,030	13,348,628	22,274,322	25,812,000	48,086,322
1920	4,446,356	8,726,846	18,701,272	31,874,474	37,857,600	69,732,074
1921	856,098	4,999,880	6,570,036	12,426,014	23,810,614	36,236,628
1922	752,836	3,826,390	5,503,387	10,082,613	27,724,000	37,806,613
1923	4,392,342	8,219,688	13,378,122	25,990,152	41,336,500	67,326,652
1924	17,026,838	7,394,182	12,613,942	37,034,962	33,778,826	70,813,788
1925	37,972,320	8,954,374	10,809,492	[1]58,218,010	38,273,938	[1]96,491,948
1926	47,145,621	8,336,519	6,575,278	[2]62,421,711	41,244,336	[2]103,666,047
1927	33,032,702	6,271,436	3,975,582	[3]43,547,441	21,324,024	[3]64,871,465
Production, 500-pound gross bales:						
1919	2,788	15,885	27,926	46,599	54,000	100,599
1920	9,302	18,257	39,124	66,683	79,200	145,883
1921	1,791	10,460	13,745	25,996	49,813	75,809
1922	1,575	8,005	11,513	21,093	58,000	79,093
1923	9,189	17,196	27,988	54,373	86,478	140,851
1924	35,621	15,469	26,389	77,479	70,667	148,146
1925	79,440	18,733	22,614	[1]121,795	80,071	[1]201,866
1926	98,631	17,441	13,756	[2]130,590	86,285	[2]216,875
1927	69,106	13,120	8,317	[3]91,103	44,611	[3]135,714

[1] 1925—3,500 acres of cotton were harvested in the Sacramento Valley, with a production of 1,000 bales (500-lb. gross), which are included in the totals in the above table.

[2] 1926—3,300 acres of cotton were harvested in the Sacramento Valley, with a production of 762 bales (500-lb. gross), which are included in the totals in the above table.

[3] 1927—2,000 acres of cotton were harvested in the Sacramento Valley with a production of 560 bales (500-lb. gross), which are included in the totals in the above table.

TABLE 10—*Cotton Acreage and Production—California, United States and World, 1910-1927*

Year	California		United States			Estimated world production in thousands of bales	Average farm price Dec. 1 (cents per lb.)	
	Acreage harvested	Production bales	Acreage planted	Acreage harvested	Production bales		California	United States
	(000 omitted)							
1910	9,000	6,300	33,418	32,403	11,609	21,915	13.3	14.1
1911	12,000	9,800	36,681	36,045	15,693	25,356	7.5	8.8
1912	9,000	8,500	34,766	34,283	13,703	25,043	12.5	11.9
1913	14,000	14,600	37,458	37,089	14,156	26,259	13.0	12.2
1914	38,000	27,126	37,406	36,832	16,135	28,687	7.0	6.8
1915	12,000	8,741	32,107	31,412	11,192	20,689	11.2	11.3
1916	60,000	41,235	36,052	34,985	11,450	19,845	20.0	19.6
1917	78,000	37,193	34,925	33,841	11,302	19,675	28.0	27.7
1918	78,000	46,908	37,207	36,008	12,041	20,613	30.0	27.6
1919	85,000	46,599	35,133	33,566	11,421	21,384	43.0	35.6
1920	150,000	66,683	37,043	35,878	13,440	20,875	30.0	13.9
1921	55,000	25,996	31,678	30,509	7,954	15,330	17.0	16.2
1922	67,000	21,093	34,016	33,036	9,762	18,900	26.0	23.8
1923	83,000	54,373	38,701	37,123	10,140	19,300	32.0	31.0
1924	129,000	77,479	42,641	41,360	13,628	24,800	24.0	22.6
1925	172,000	121,795	48,090	46,053	16,104	27,900	22.0	18.2
1926	162,000	130,590	48,730	47,087	17,911	28,000	14.0	10.9
1927	128,000	91,103	41,905	40,138	12,955	23,600	21.0	19.6

TABLE 11—*December 1 Farm Price of California Crops, 1868-192*

Year	Wheat, cents per bushel	Corn, cents per bushel	Oats, cents per bushel	Barley, cents per bushel	Rice, cents per bushel	Potatoes, cents per bushel	Sweet potatoes, cents per bushel	*Tame hay, dollars per ton	Wild hay, dollars per ton	Cotton, cents per pound
1868	103	100	70	103	.....	56	.....	15.00	.....	.....
1869	93	90	62	65	.....	79	132	12.70	.....	.....
1870	110	120	59	98	.....	135	145	16.70	.....	.....
1871	141	116	70	108	.....	91	110	21.85	.....	.....
1872	111	100	74	85	.....	113	94	15.60	.....	.....
1873	132	73	84	85	.....	85	113	16.50	.....	.....
1874	99	98	69	78	.....	111	112	15.09	.....	.....
1875	118	107	72	91	.....	94	116	16.59	.....	.....
1876	114	107	74	69	.....	83	.....	11.61	.....	.....
1877	130	95	73	90	.....	75	.....	15.00	.....	.....
1878	103	60	69	65	.....	98	.....	12.61	.....	.....
1879	123	79	67	56	.....	65	78	9.93	.....	.....
1880	96	76	65	61	.....	79	92	12.72	.....	.....
1881	103	78	60	70	.....	80	.....	12.20	.....	.....
1882	90	85	58	67	.....	60	87	13.00	.....	.....
1883	100	85	58	63	.....	60	83	12.50	.....	.....
1884	72	60	38	52	.....	60	83	10.31	.....	.....
1885	67	68	48	79	.....	63	.....	11.50	.....	.....
1886	73	62	44	65	.....	66	64	8.15	.....	.....
1887	74	61	58	52	.....	57	81	11.50	.....	.....
1888	85	70	60	58	.....	61	85	12.03	.....	.....
1889	70	57	45	45	.....	45	63	9.25	.....	.....
1890	76	65	56	75	.....	68	70	10.50	.....	.....
1891	95	71	60	61	.....	54	76	11.00	.....	.....
1892	68	55	40	47	.....	59	.....	8.76	.....	.....
1893	53	50	38	42	.....	50	.....	7.87	.....	.....
1894	57	57	44	45	.....	49	61	9.50	.....	.....
1895	60	53	39	40	.....	48	73	7.06	.....	.....
1896	83	53	44	48	.....	53	56	6.35	.....	.....
1897	83	56	49	54	.....	49	60	9.00	.....	.....
1898	72	62	50	65	.....	55	.....	14.25	.....	.....
1899	62	60	47	50	.....	63	67	8.00	.....	.....
1900	58	61	46	43	.....	53	63	8.15	.....	.....
1901	60	68	44	41	.....	77	65	7.92	.....	.....
1902	80	77	51	63	.....	58	76	9.41	.....	.....
1903	87	74	54	61	.....	66	84	11.66	.....	.....
1904	88	78	57	60	.....	67	77	10.41	.....	.....
1905	82	76	51	59	.....	67	75	10.05	.....	.....
1906	75	67	52	54	.....	74	90	11.25	.....	.....
1907	98	85	71	78	.....	90	97	12.50	.....	.....
1908	102	88	67	74	.....	77	80	13.25	.....	.....
1909	111	91	66	74	.....	77	90	11.50	.....	.....
1910	94	80	50	55	65	85	95	9.60	.....	13.3
1911	88	90	59	85	75	90	110	10.90	.....	7.5
1912	93	85	55	70	91	65	94	13.70	.....	12.5
1913	95	88	60	68	100	70	100	13.50	.....	13.0
1914	104	87	53	59	100	70	87	8.20	6.00	7.0
1915	95	88	50	62	90	75	80	11.20	9.00	11.2
1916	152	124	72	95	78	140	100	12.60	11.00	20.0
1917	200	185	85	120	175	150	150	19.20	13.50	28.0
1918	216	193	94	115	190	120	150	20.00	19.00	30.0
1919	204	179	96	141	267	171	179	17.20	12.00	43.0
1920	180	120	80	100	121	150	160	20.00	12.00	30.0
1921	107	77	51	56	115	130	125	11.00	7.00	17.0
1922	115	100	64	63	110	72	67	15.00	9.00	26.0
1923	108	108	60	70	112	112	165	14.00	10.00	32.0
1924	154	138	87	116	166	90	218	21.70	17.00	24.0
1925	148	118	61	75	170	200	170	14.00	8.50	22.0
1926	130	106	48	58	131	132	110	12.30	7.50	14.0
1927	118	108	63	93	115	95	115	12.50	8.50	21.0

*Includes alfalfa, grain hay and miscellaneous tame hay.

REVIEW OF THE 1927 VEGETABLE SEASONS

A review of the truck crop situation in 1927 in California reveals several interesting facts and lessons. Weather conditions were generally satisfactory throughout the year, and in some districts they were almost ideal for the production of certain crops. Average or above average yields were possible with practically all commercially grown vegetables with the exception of early potatoes and fall tomatoes. Yet the actual harvested yield was below the average in many of the more perishable vegetables largely due to the fact that the entire crop could not be marketed at a profit. The increase in the area devoted to all commercial vegetable crops in 1927 was approximately 29,000 acres above the acreage of 1926 and about 88,000 acres greater than in 1925. The value in 1927 was $1,276,000 above the value in 1926 and $9,134,000 greater than in 1925.

A few of California's important vegetables made very satisfactory profits for the growers. These were cauliflower, spring lettuce, Bermuda onions and strawberries. The principal crops bringing unsatisfactory returns to the producers were artichokes, celery, late onions and cantaloupes and lettuce in the Imperial Valley. The balance of the crops listed in Table 12, with the exception of the canning crops, varied between poor and fair from the standpoint of returns to the grower.

The year 1927 on the average was not a profitable year for the grower. The outstanding factor that spelled loss seemed to be over-production. With every crop that showed a large increase in acreage the growers made very little profit or suffered losses. On the other hand the crops showing no increase or a conservative increase in acreage made the growers some profit. The lessons learned the past year are obvious, and the need for conservative plantings can not be too strongly emphasized.

There are four distinct shipping seasons for California vegetables. These seasons correspond with the seasons of the year. The California grower does not talk of vegetables without prefixing the word winter, spring, summer or fall, for each season presents different problems of growing and marketing.

Winter Vegetables—For the grower of winter vegetables weather conditions were generally satisfactory for the production of good yields and high quality. However, the winter deals of the main crops, with the exception of cauliflower, were for the most part unprofitable. The area planted to lettuce in the Imperial Valley was 6000 acres greater than in 1926. The actual harvested yield per acre was only 104 crates, the lowest yield in the history of the valley. The equivalent of over 5000 cars of lettuce was left in the fields. Celery in all sections of the state was a disappointment from the standpoint of returns. With above average yields on an acreage 31 per cent greater than the five-year average, coupled with a heavier crop in New York and an early crop in Florida, there was little chance for reasonable profits in the California winter celery deal. Cauliflower presented the one "bright spot" of the winter season. High yields of good quality prevailed and reasonable profits were returned to the growers.

Spring Vegetables—An abundance of rain fell during the early spring months, which was of benefit to some crops and detrimental to others. In the Central Coast Districts rains were so plentiful that farmers were unable to plant early and some crops were two to three weeks late. Cool growing weather retarded growth of spring lettuce to such an

extent that small sizes and low yields prevailed during most of the season. However, the spring lettuce deal from the standpoint of price was very satisfactory. Spring cauliflower was the outstanding crop from the standpoint of production and profit to the grower. Weather conditions in the main producing sections of the state were excellent for cauliflower and high yields of high quality were the result.

The carrot is the latest vegetable crop in California to attain commercial importance and the production has increased enormously in the past four years. The area devoted to carrots has increased from 500 acres in 1924 to 3050 acres in 1927, while carlot shipments have jumped from 166 cars in 1924 to 2791 cars in 1927. The largest carrot district in the state is the Santa Maria Valley (Santa Barbara County) where 1730 acres were grown in 1927. Ventura County, the Salinas Valley, Sacramento District and Los Angeles County were the other important producing districts. The limit of profitable production, for a few years at least, was apparently reached during the spring deal of 1927. Low prices caused the abandonment of about 600 acres.

The Imperial Valley enjoyed a favorable growing season for cantaloupes and high yields were obtained of the best quality melons the valley had produced in several years. A large increase in production and light demand on account of cold weather in the consuming markets resulted in a disastrous season for the growers.

Coachella Valley Bermuda onions were grown under favorable conditions and a good crop resulted. Contrary to early forecasts of low prices, onions brought good returns and the growers generally enjoyed a profitable season. The late Bermuda crop in Kern and Tulare counties was also satisfactory. Early potatoes in most districts of the state suffered from adverse weather conditions and in many localities insect pests and plant diseases were prevalent. Yields were generally light, with the exception of the northern sections which produced about average crops.

Weather factors aided the production of a large crop of spring peas in the main producing sections, and linked with the enormous increase in acreage, overproduction was inevitable. The majority of districts suffered an unprofitable season. Strawberries in all districts were greatly benefited by the early spring rains High yields were obtained from both first and second crops. Good profits were returned to the growers.

Summer Vegetables—Weather conditions favored the production of the important summer crops. Above average yields were harvested from cantaloupes, watermelons, onions and summer lettuce. Summer lettuce returned fair profits. The market for California late onions was seriously affected by a heavy production in other parts of the United States. Cantaloupes and watermelons in the San Joaquin Valley districts netted the growers fair returns.

Fall Vegetables—The acreage of fall lettuce was increased heavily over the acreage planted in 1926. Average yields and good quality prevailed during most of the season in the main districts. Returns to the growers were only fair. Fall tomatoes were widely planted in all southern California districts. The planted acreage was about 80 per cent greater than in 1926. Growing conditions were exceptionally favorable during the early part of the season and high yields were in evidence. Late Blight put in its appearance about the middle of October and spread rapidly throughout practically every tomato district of southern California. By November 15 Late Blight had taken most of the fields, and a majority of the growers experienced a very unprofitable season.

VEGETABLE CROPS

California is still the leading state in the production of vegetables. The area devoted to commercial vegetables has increased in the past six years from 187,570 acres to 355,940 acres. In Table 1 are included estimates of total acreage and value of all vegetable crops in California from 1923 to 1927, inclusive. Table 12 shows the acreage, production and value of specified commercial vegetable crops. Other vegetables of less gross importance have been grouped under the heading "All other vegetables." Potatoes and sweet potatoes are classed as field crops in this report. The value of vegetable crops in this table is calculated both on cash to grower and f.o.b. basis in order to maintain comparative values with other states.

TABLE 12—*Acreage Production and Value of Specified Truck Crops, 1925-1927*

Crop		Acreage	Production	Unit	Value
Artichokes	1927	9,940	1,272,000	40 lb. boxes	$2,569,000
	1926	11,760	1,470,000	40 lb. boxes	2,602,000
	1925	10,550	1,266,000	40 lb. boxes	2,279,000
Asparagus (canning)	1927	48,300	53,100	Tons	3,717,000
	1926	46,300	50,900	Tons	3,374,000
	1925	34,800	45,200	Tons	3,542,000
Asparagus (table)	1927	10,080	1,341,000	28-lb. crates	4,010,000
	1926	9,980	1,856,000	28 lb. crates	6,051,000
	1925	6,600	1,115,000	28 lb. crates	2,286,000
Beans, green (canning)	1927	450	2,000	Tons	170,000
	1926	700	3,200	Tons	259,000
	1925	700	1,400	Tons	112,000
Beans, green (table)	1927	3,120	484,000	24 lb. hampers	997,000
	1926	3,000	645,000	24 lb. hampers	940,000
	1925	2,000	430,000	24 lb. hampers	752,000
Cabbage	1927	6,400	38,400	Tons	1,190,000
	1926	6,480	42,100	Tons	1,201,000
	1925	6,080	42,600	Tons	781,000
Cantaloupes (Imperial)[1]	1927	37,920	6,044,000	Standard crates	9,006,000
	1926	35,300	5,048,000	Standard crates	6,512,000
	1925	27,560	4,961,000	Standard crates	10,269,000
Cantaloupes (other districts)[1]	1927	7,800	1,513,000	Standard crates	2,723,000
	1926	8,380	1,575,000	Standard crates	2,520,000
	1925	10,620	1,699,000	Standard crates	1,971,000
Carrots	1927	3,050	763,000	Lettuce crates	1,091,000
	1926	1,800	482,000	Lettuce crates	694,000
	1925	1,000	285,000	Lettuce crates	527,000
Cauliflower	1927	8,950	2,452,000	Pony crates	2,452,000
	1926	10,500	3,224,000	Pony crates	2,837,000
	1925	6,610	2,148,000	Pony crates	2,384,000
Celery	1927	8,850	1,328,000	California crate	2,961,000
	1926	8,550	1,385,000	California crate	3,782,000
	1925	6,250	913,000	California crate	2,040,000
Cucumbers	1927	2,120	8,087	Tons	327,000
	1926	2,560	8,855	Tons	343,000
	1925	3,210	11,784	Tons	535,000
Lettuce (Imperial)	1927	34,400	3,578,000	4 doz. crates	4,795,000
	1926	28,000	4,900,000	4 doz. crates	9,555,000
	1925	23,000	4,600,000	4 doz. crates	7,866,000

TABLE 12—*Acreage, Production and Value of Specified Truck Crops, 1925-1927*—Continued

Crop		Acreage	Production	Unit	Value
Lettuce (other districts)	1927	42,010	6,049,000	4 doz. crates	10,586,000
	1926	37,100	5,565,000	4 doz. crates	7,624,000
	1925	24,680	4,368,000	4 doz. crates	5,067,000
Onions (Bermuda)	1927	3,950	1,118,000	Bushels	2,012,000
	1926	2,850	926,000	Bushels	1,287,000
	1925	1,550	488,000	Bushels	849,000
Onions (late)	1927	5,800	2,053,000	Bushels	1,560,000
	1926	6,250	1,781,000	Bushels	1,140,000
	1925	5,850	1,755,000	Bushels	2,036,000
Peas (canning)	1927	750	1,000	Tons	60,000
	1926	2,680	3,200	Tons	208,000
	1925	4,890	3,400	Tons	217,000
Peas (table, Imperial)	1927	5,700	365,000	32 qt. hampers	$774,000
	1926	4,000	400,000	32 qt. hampers	944,000
	1925	1,400	66,000	32 qt. hampers	169,000
Peas (table, other districts)	1927	21,110	2,132,000	32 qt. hampers	4,221,000
	1926	11,950	598,000	32 qt. hampers	2,727,000
	1925	5,100	224,000	32 qt. hampers	618,000
Spinach (canning)	1927	10,300	51,500	Tons	747,000
	1926	9,590	46,000	Tons	743,000
	1925	9,690	29,100	Tons	513,000
Spinach (table)	1927	1,900	760,000	24 lb. crates	456,000
	1926	2,290	916,000	24 lb. crates	495,000
	1925	1,810	452,500	24 lb. crates	262,000
Strawberries (southern)	1927	1,620	8,664,000	Quarts	2,079,000
	1926	820	3,317,000	Quarts	597,000
	1925	1,150	5,060,000	Quarts	961,000
Strawberries (other districts)	1927	2,130	9,149,000	Quarts	2,072,000
	1926	2,090	8,747,000	Quarts	1,749,000
	1925	2,020	10,100,000	Quarts	2,323,000
Tomatoes (canning)	1927	28,760	178,300	Tons	2,675,000
	1926	32,250	206,400	Tons	3,222,000
	1925	30,000	180,000	Tons	2,932,000
Tomatoes (table)	1927	22,750	2,630,000	36 lb. lugs	2,097,000
	1926	13,090	3,297,000	36 lb. lugs	2,733,000
	1925	12,160	3,860,000	36 lb. lugs	4,281,000
Watermelons (Imperial)	1927	5,500	3,597	Cars	432,000
	1926	6,000	4,560	Cars	456,000
	1925	4,000	3,000	Cars	750,000
Watermelons (other districts)	1927	4,280	1,644	Cars	229,000
	1926	6,820	3,008	Cars	337,000
	1925	6,370	2,548	Cars	502,000
All other vegetables[2]	1927	18,000	73,000	Tons	2,600,000
	1926	16,000	64,000	Tons	2,400,000
	1925	18,500	74,000	Tons	2,750,000
Totals	1927	355,940			$68,608,000
	1926	327,090			67,332,000
	1925	268,150			59,574,000

[1] Includes cantaloupes, honeydews, honeyballs, casabas and Persians.
[2] Includes endive, peppers, beets, radishes, rhubarb, pumpkins, squash, sweet corn and turnips.

SHIPMENTS OF CALIFORNIA VEGETABLES

In Table 13 are given the carlot shipments of specified California vegetables by months for the calendar years 1922 to 1927, inclusive. The different crop seasons as well as the volume of shipments and the increase or decrease in shipments from year to year can readily be determined by a study of this table.

The total shipments of all vegetables listed have increased during the six-year period, 1922 to 1927, from 55,881 carloads to 95,967 carloads. The majority of the vegetables have shared in this increase, with carrots showing the greatest gain, having jumped from 22 cars in 1922 to 836 cars in 1926, and 2791 cars in 1927. Lettuce shipments increased during the six-year period from 9764 cars to 27,493 cars. Celery and tomato shipments have practically doubled in six years, while asparagus shipments about tripled. The carlot movement of cabbage, cucumbers, onions, peppers and spinach has remained about the same, while potatoes and strawberries have shown some decrease.

Total shipments for 1927 show lettuce leading the list with 27,493 cars. Cantaloupes are second with 22,631 cars and celery is third with 7362 cars.

TABLE 13—*Carlot Shipments of California Vegetables by Months—1922-1927*

Crop		1922	1923	1924	1925	1926	1927
Artichokes	Jan.	22	34	42	77	102	157
	Feb.	16	53	102	200	257	168
	Mar.	48	261	237	428	442	154
	April	110	207	360	198	130	145
	May	109	22	44	30	19	62
	June	2		2	4		
	July				2		
	Aug.		1	1	15		
	Sept.		14	16	18	29	9
	Oct.	5	62	40	52	116	48
	Nov.	18	102	80	70	241	85
	Dec.	22	53	79	103	182	76
Totals		352	809	1,003	1,197	1,518	904
Asparagus	Jan.						
	Feb.			6	10	1	
	Mar.	17	83	216	525	691	188
	April	177	247	346	567	563	636
	May	64	79	93	109	173	204
	June	46	49	54	67	64	118
	July			3	1		1
	Aug.						
	Sept.						
	Oct.					14	
	Nov.					4	6
	Dec.						1
Totals		304	458	718	1,279	1,510	1,154
Beans, green	Jan.						
	Feb.						
	Mar.			2			
	April		3		18	32	1
	May	4	23	24	78	93	56
	June	16		6	5	4	2
	July						
	Aug.						
	Sept.						
	Oct.				1	2	
	Nov.				16	1	
	Dec.						1
Totals		20	26	32	118	132	60

TABLE 13—Car-lot shipments of California Vegetables by Months, 1922-1927—Continued

Crop		1922	1923	1924	1925	1926	1927
Cabbage	Jan.	156	23	61	50	146	72
	Feb.	86	49	57	44	[illegible]	71
	Mar.	115	[illegible]	62	70	[illegible]	90
	April	144	167	25	46	76	41
	May	142	106	104	208	61	74
	June	60	27	12	105	30	8
	July	.....	2	9	46	5	6
	Aug.	.....	.....	11	2	5	1
	Sept.	10	1	11	9	4	8
	Oct.	8	7	3	21	.....	2
	Nov.	1	2	2	31	2	.....
	Dec.	7	5	13	5	24	3
Totals		738	683	370	644	677	487
Cantaloupes[1] (Imperial Valley)	Jan.	.....	.....	.....	.....	.....	.....
	Feb.	.....	.....	.....	.....	.....	.....
	Mar.	.....	.....	.....	.....	.....	.....
	April	.....	.....	.....	.....	1	.....
	May	4	797	1,213	1,477	5,772	1,772
	June	8,660	9,923	11,647	4,778	[illegible]	[illegible]
	July	3,579	2,271	3,060	2,718	1,245	[illegible]
	Aug.	1	8	13	13	10	224
	Sept.	.....	.....	.....	.....	.....	.....
	Oct.	.....	.....	.....	.....	.....	4
	Nov.	.....	.....	.....	.....	14	115
	Dec.	.....	.....	.....	.....	1	4
Totals		12,243	12,999	15,933	13,982	14,122	13,062
Cantaloupes[1] (other districts)	Jan.	.....	.....	.....	.....	.....	.....
	Feb.	.....	.....	.....	.....	.....	.....
	Mar.	.....	.....	.....	.....	.....	.....
	April	.....	.....	.....	.....	.....	.....
	May	.....	.....	.....	.....	.....	.....
	June	.....	.....	.....	30	60	.....
	July	1,630	932	1,718	1,611	2,013	1,102
	Aug.	1,138	1,597	1,618	1,810	1,136	1,880
	Sept.	229	603	426	682	597	1 [illegible]
	Oct.	64	314	222	402	[illegible]	[illegible]
	Nov.	.....	48	16	115	71	47
	Dec.	.....	.....	.....	18	3	.....
Totals		3,061	3,494	4,000	4,668	4,241	4,579
Carrots	Jan.	1	.....	19	47	68	255
	Feb.	8	.....	2	8	32	47
	Mar.	.....	.....	1	12	41	228
	April	1	.....	3	34	107	243
	May	2	20	83	94	163	324
	June	7	3	37	64	125	677
	July	1	.....	2	6	6	25
	Aug.	1	.....	2	.....	2	2
	Sept.	.....	.....	3	.....	.....	20
	Oct.	.....	.....	1	1	[illegible]	109
	Nov.	.....	1	.....	48	87	325
	Dec.	1	3	13	18	[illegible]	286
Totals		22	27	[illegible]	332	[illegible]	1,741

[1]Includes straight cars of cantaloupes, honeydews, Casabas, Persians, mixtures, and cars of mixed melons.

TABLE 13—*Carlot Shipments of California Vegetables by Months, 1922-1927*—Continued

Crop		1922	1923	1924	1925	1926	1927
Cauliflower	Jan.	580	1,141	618	838	878	1,150
	Feb.	544	698	872	818	896	887
	Mar.	1,037	802	591	429	840	800
	April	116	92	83	213	230	487
	May	12	22	81	84	45	452
	June	16	17	6	5	----	10
	July	----	7	----	4	----	----
	Aug.	4	5	17	5	6	----
	Sept.	11	8	1	4	1	4
	Oct.	14	33	52	127	50	77
	Nov.	65	443	376	348	406	598
	Dec.	738	307	571	975	484	792
Totals		3,137	3,575	3,268	3,850	3,836	5,257
Celery	Jan.	868	1,157	1,108	963	1,466	2,176
	Feb.	80	516	422	386	506	629
	Mar.	82	229	434	360	361	680
	April	19	7	49	74	151	223
	May	----	3	65	191	145	424
	June	1	39	84	202	347	315
	July	2	34	55	77	126	112
	Aug.	3	18	6	4	49	30
	Sept.	4	2	2	3	8	2
	Oct.	59	85	72	124	83	90
	Nov.	888	905	860	1,317	920	1,036
	Dec.	1,468	1,532	1,362	1,638	1,862	1,645
Totals		3,474	4,527	4,519	5,339	6,024	7,362
Cucumbers	Jan.	----	----	----	----	----	----
	Feb.	----	----	----	----	----	----
	Mar.	----	----	----	----	----	----
	April	----	----	----	----	----	----
	May	----	23	----	2	22	----
	June	33	59	10	22	33	13
	July	35	8	7	14	----	6
	Aug.	----	25	6	34	18	----
	Sept.	----	9	----	30	2	4
	Oct.	----	1	----	10	----	9
	Nov.	----	----	----	13	7	25
	Dec.	----	----	----	----	4	6
Totals		68	125	23	125	86	63
Lettuce (Imperial Valley)	Jan.	1,032	1,798	2,189	1,782	3,257	3,560
	Feb.	872	1,988	3,183	2,583	3,231	4,191
	Mar.	1,285	3,015	2,433	4,050	3,438	2,394
	April	1,242	570	1,127	1,086	430	72
	May	----	----	----	----	----	----
	June	----	----	----	----	----	----
	July	----	----	----	----	----	----
	Aug.	----	----	----	----	----	----
	Sept.	----	----	----	----	----	----
	Oct.	----	----	----	----	----	----
	Nov.	----	----	----	----	6	----
	Dec.	342	616	365	806	730	367
Totals		4,773	7,987	9,297	10,307	11,092	10,584

TABLE 13—*Carlot Shipments of California Vegetables by Months, 1922-1927*—Continued

Crop		1922	1923	1924	1925	1926	1927
Lettuce (other districts)	Jan.	280	155	67	142	42	28
	Feb.	30	55	2	80	10	9
	Mar.	171	212	28	43	116	66
	April	772	1,089	1,164	1,416	1,453	1,657
	May	1,294	1,410	1,952	2,410	2,953	3,258
	June	391	430	839	934	1,893	1,226
	July	184	395	380	640	1,176	1,282
	Aug.	104	507	203	505	584	1,396
	Sept.	91	296	280	695	1,244	1,715
	Oct.	220	450	1,094	1,843	2,970	2,949
	Nov.	676	1,241	2,065	1,838	2,425	2,719
	Dec.	758	886	1,109	765	1,443	604
Totals		4,971	7,126	9,183	11,311	16,309	16,909
Mixed vegetables	Jan.	294	428	335	600	575	590
	Feb.	156	411	330	415	520	518
	Mar.	282	547	319	475	518	706
	April	283	492	293	407	422	588
	May	324	414	407	482	376	636
	June	287	251	394	321	239	277
	July	184	283	303	232	307	235
	Aug.	196	242	247	198	224	222
	Sept.	204	179	217	189	216	198
	Oct.	351	171	214	293	433	257
	Nov.	595	479	533	655	580	517
	Dec.	581	440	692	606	721	538
Totals		3,737	4,337	4,284	4,873	5,131	5,282
Onions	Jan.	187	175	301	65	213	82
	Feb.	105	91	154	90	93	41
	Mar.	125	195	293	86	188	32
	April	48	57	114	35	87	97
	May	997	700	691	744	1,065	1,432
	June	599	340	658	295	452	517
	July	208	117	193	544	187	280
	Aug.	274	305	338	515	351	318
	Sept.	474	716	282	324	321	455
	Oct.	227	555	113	256	195	164
	Nov.	168	334	66	247	144	111
	Dec.	143	215	48	112	140	130
Totals		3,555	3,800	3,251	3,313	3,436	3,659
Peas, green[2]	Jan.	.....	.....	.....	.....	4	.....
	Feb.	.....	.....	.....	.....	13	25
	Mar.	.....	.....	.....	204	110	342
	April	.....	.....	.....	135	208	171
	May	.....	.....	.....	73	75	264
	June	.....	.....	.....	4	33	27
	July	.....	.....	.....	6	25	2
	Aug.	.....	.....	.....	7	22	22
	Sept.	.....	.....	.....	8	14	82
	Oct.	.....	.....	.....	14	57	109
	Nov.	.....	.....	.....	227	230	211
	Dec.	.....	.....	.....	94	41	93
Totals		.....	.....	.....	772	832	1,348

[2] Shipments of peas prior to 1925 not available.

TABLE 13—*Carlot Shipments of California Vegetables by Months, 1922-1927*—Continued

Crop		1922	1923	1924	1925	1926	1927
Peppers	Jan.						1
	Feb.						
	Mar.						1
	April						
	May						
	June			1			
	July		1				1
	Aug.	1					
	Sept.	2	1	5	1	8	1
	Oct.	15	6	25	40	47	11
	Nov.	27	12	1	20	37	18
	Dec.	14				7	4
Totals		59	20	32	61	99	37
Potatoes	Jan.	737	739	437	532	501	410
	Feb.	566	544	258	343	298	263
	Mar.	584	420	153	210	186	103
	April	331	201	44	125	114	109
	May	183	152	111	177	400	150
	June	956	787	549	574	1,364	883
	July	1,473	717	784	848	771	927
	Aug.	744	637	823	1,019	949	1,252
	Sept.	623	854	956	976	1,043	993
	Oct.	719	706	788	677	736	743
	Nov.	717	538	709	334	542	744
	Dec.	582	470	635	354	450	661
Totals		8,215	6,765	6,247	6,169	7,354	7,238
Spinach	Jan.	25	23	3	16	49	25
	Feb.	2	12	2	18	11	10
	Mar.	9	93	13	118	47	97
	April	151	325	37	57	100	212
	May	96		13			34
	June				5		
	July				1		
	Aug.						
	Sept.					1	
	Oct.					8	
	Nov.		1		41	55	2
	Dec.	20	1	26	47	12	15
Totals		303	455	94	303	283	395
Strawberries	Jan.						
	Feb.						
	Mar.			1	5	8	2
	April	6	21	73	36	56	29
	May	169	171	116	89	40	143
	June	26					5
	July		2	1			
	Aug.		32				
	Sept.						
	Oct.						
	Nov.						
	Dec.						
Totals		201	226	191	130	104	179

TABLE 13—*Carlot Shipments of California Vegetables by Months, 1922-1927*—Continued

Crop		1922	1923	1924	1925	1926	1927
Tomatoes	Jan.		3		1	1	
	Feb.					1	
	Mar.						
	April				1	11	1
	May		97	42	53	190	83
	June	52	183	89	100	127	129
	July	164	178	137	104	126	134
	Aug.	177	268	205	106	177	70
	Sept.	740	902	697	457	1,001	735
	Oct.	904	1,146	1,105	1,608	2,007	2,691
	Nov.	274	497	475	472	712	717
	Dec.	35	22	38	59	70	11
Totals		2,346	3,296	2,788	2,961	4,423	4,571
Watermelons	Jan.						
	Feb.						
	Mar.						
	April						
	May		26	15	82	359	53
	June	748	1,232	1,079	1,616	2,945	1,687
	July	1,971	1,435	1,975	1,748	2,333	2,438
	Aug.	1,115	848	915	788	594	805
	Sept.	431	407	291	227	128	170
	Oct.	37	104	30	59	5	33
	Nov.		2		2		
	Dec.						
Totals		4,302	4,054	4,305	4,522	6,364	5,186
Grand total, all vegetables		55,881	64,789	69,704	76,256	88,309	95,967

VEGETABLE IMPORTS FROM MEXICO

The California vegetable grower is much interested in the rapidly increasing imports of vegetables from Mexico into the United States.

Table 14 gives the carlot shipments of the important vegetables imported into the United States from Mexico by months for the calendar years 1922-1927, inclusive. These data are important in showing the extent of carlot imports, the time of heavy shipping, and the competition offered similar crops grown in California.

Carlot imports of vegetables of minor importance for the calendar year 1927 were: String beans, 4 cars; cucumbers, 4 cars; egg plant, 1 car; lettuce, 3 cars; onions, 2 cars; and potatoes, 8 cars.

The greater part of the imports of Mexican vegetables are from the West Coast although a portion (principally tomatoes) are from the East Coast, entering the United States through the border port of Laredo, Texas.

California was the largest consumer of Mexican West Coast perishables during the 1926-27 season, and was followed in order of importance by New York, Illinois and Pennsylvania. These four states consumed 58 per cent of the total number of carloads shipped into the United States through the port of Nogales, Arizona. During the 1926-27 season California received from Mexico 711 cars of tomatoes and 218 cars of other vegetables by rail. California also received the equivalent of 195 carloads of tomatoes by water from Lower California. San Francisco took 25 cars of the boat shipments; Los Angeles, 75; and San Diego, 95.

TABLE 14—*Carlot Imports of Specified Vegetables from Mexico into the United States by Months, 1922-1927*

Crop		1922	1923	1924	1925	1926	1927
Cantaloupes[1]	Jan.						
	Feb.						
	Mar.			1			
	April	17	2	63		36	
	May	27	99	50	140	265	
	June	26			38		
	July	1					
	Aug.						
	Sept.						
	Oct.						
	Nov.			3			
	Dec.			7			
Totals		71	101	124	178	301	
Mixed vegetables	Jan.	7	10	3	11	32	9
	Feb.	9	2	19	30	60	15
	Mar.	15	27	21	8	25	4
	April	13	17	82	25	32	12
	May	25	11	31	7	4	12
	June	5		3	1		3
	July						
	Aug.						
	Sept.						
	Oct.						
	Nov.		3				
	Dec.			1	2	1	
Totals		74	70	160	84	154	55

[1] Includes honeydews. 1927 shipments not available.

TABLE 14.—*Carlot Imports of Specified Vegetables from Mexico into the United States by Months, 1922-1927*—Continued

Crop		1922	1923	1924	1925	1926	1927
Peas, green[2]	Jan.					159	181
	Feb.					243	521
	Mar.					139	145
	April				9	5	3
	May						
	June						
	July						
	Aug.						
	Sept.						
	Oct.						
	Nov.						1
	Dec.				53	61	74
Totals					62	607	925
Peppers[2]	Jan.					45	77
	Feb.					29	176
	Mar.					27	77
	April					57	54
	May					8	21
	June						3
	July						
	Aug.						
	Sept.						
	Oct.						
	Nov.					1	
	Dec.				26	11	6
Totals					26	178	414
Tomatoes	Jan.	62	214	71	266	447	452
	Feb.	220	383	91	300	582	1,063
	Mar.	274	414	278	483	845	1,306
	April	388	472	728	1,136	654	1,406
	May	175	291	660	522	320	285
	June	9	3	60	19	17	
	July						
	Aug.				1		
	Sept.						
	Oct.						
	Nov.				4	7	37
	Dec.	24	16	50	151	277	267
Totals		1,152	1,793	1,938	2,882	3,149	4,816
Grand totals		1,297	1,964	2,222	3,232	4,389	6,210

[2] 1925 shipments incomplete. No data available prior to 1925.

CANNED VEGETABLES

Table 15 gives the yearly pack of the principal vegetables canned in California from 1900 to 1927, inclusive. This table was prepared from data compiled by the California Fruit News and the Canners League of California. There were no data available on spinach prior to 1919 or on string beans prior to 1906. These products are included in "Other Vegetables" where not listed separately. No data were available on tomato products before 1917, but presumably "Tomatoes" included tomato products prior to that year.

TABLE 15—*Comparative Packs of Canned Vegetables, California*
(*Number of cases, all grades and sizes*)

Year	Asparagus, cases	Beans, string, cases	Peas, cases	Spinach, cases	Tomatoes, cases	Tomato products, cases	Other vegetables, cases	Total, cases
1900	143,861	.....	57,466	.....	266,550	.....	35,740	503,617
1901	187,592	.....	102,089	.....	748,440	.....	37,937	1,076,058
1902	227,126	.....	57,710	.....	827,052	.....	39,380	1,151,268
1903	256,220	.....	70,487	.....	958,295	.....	58,572	1,343,574
1904	224,877	.....	71,233	.....	566,114	.....	99,559	961,783
1905	228,439	.....	56,170	.....	834,571	.....	73,285	1,192,465
1906	295,890	60,800	142,400	.....	1,376,500	.....	86,250	1,961,840
1907	175,300	85,740	58,655	.....	1,732,120	.....	134,835	2,186,650
1908	238,755	40,920	95,250	.....	1,199,550	.....	34,850	1,609,325
1909	411,595	14,380	119,660	.....	777,220	.....	47,750	1,370,605
1910	620,500	50,890	194,695	.....	1,540,745	.....	88,995	2,495,825
1911	689,170	78,530	206,980	.....	1,724,810	.....	87,515	2,787,005
1912	723,500	92,020	287,575	.....	1,845,300	.....	124,440	3,072,835
1913	729,350	97,125	100,770	.....	1,303,570	.....	174,055	2,404,870
1914	775,585	86,270	174,870	.....	2,106,350	.....	149,415	3,292,490
1915	809,860	98,220	209,399	.....	1,344,085	.....	145,650	2,607,214
1916	990,740	123,385	227,120	.....	2,647,300	.....	236,525	4,225,070
1917	965,708	169,326	472,670	.....	3,346,104	1,356,755	637,206	6,947,769
1918	902,236	155,123	265,970	.....	3,884,973	1,809,805	1,267,713	8,285,820
1919	1,031,269	154,278	191,564	476,866	3,809,979	885,906	501,657	7,051,519
1920	1,024,813	99,269	366,679	685,228	1,858,822	833,019	382,116	5,249,946
1921	887,030	97,815	86,074	434,068	357,092	495,101	258,767	2,615,947
1922	1,239,839	150,988	473,260	1,180,525	1,925,389	1,498,617	444,753	6,913,371
1923	1,519,756	96,793	223,923	1,383,831	2,924,909	1,283,198	368,425	7,800,835
1924	1,792,769	146,993	242,295	1,072,893	2,155,453	1,292,273	436,083	7,138,759
1925	1,744,999	131,346	270,727	1,805,537	2,259,314	1,790,127	525,841	8,527,891
1926	2,236,111	31,431	216,511	1,339,357	3,190,822	2,126,105	406,938	9,547,275
1927	2,189,570	113,708	52,914	1,968,668	2,913,864	1,097,423	393,233	8,729,380

FRUIT CROPS

The latest revised estimates of production and farm value relating to the main fruit crops of California for the years 1923 to 1927 are shown in Table 16. In other tables and the discussion that follows are given more details and additional information.

Apples—The 1927 crop of apples amounted to 7,458,000 boxes, which is equal to 72 per cent of the 1926 crop. The commercial production or that part of the crop consumed fresh was estimated at 4,656,000 boxes. In 1926 there were 6,144,000 boxes so utilized. Gravensteins, the most important summer variety, were light, being about 55 per cent of a normal production. The crop of Bellefleurs, the principal fall variety, was also light; but the crop of Newtown Pippins, the leading winter variety, was good. In Southern California where most of the Rome Beauties, Winesap and Delicious are produced there was only half a crop. Carlot shipments of all apples to May 19, 1928, totaled 3937 cars compared with 5060 to the same date last year. Total shipments for the 1926 crop amounted to 5083 cars. Truck shipments have been increasing yearly until now a substantial part of the commercial crop moves to the market in that manner. There were 6250 tons of dried apples produced compared with 10,500 in 1926 and 5755 in 1925. From present information on plantings the increase in the bearing acreage will be slight during the next four years.

Peaches—A final check of the 1927 crop of peaches indicates a total production of 492,000 tons of all varieties. In 1926 the total production amounted to 541,000 tons. There were 322,000 tons of clingstone peaches produced in 1927, of which 230,000 tons were canned, 27,000 tons shipped to out-of-state markets and consumed fresh within the state, and about 65,000 tons wasted. In 1926, there were 327,000 tons of clingstones produced, of which 317,000 tons were canned and 10,000 tons shipped to eastern markets or used in the fresh state within California. The 1927 season was the first in which a considerable quantity of clingstone peaches was shipped east. The production of freestone peaches amounted to 170,000 tons in 1927 of which 95,000 tons were utilized for drying, 7500 tons canned and 67,500 tons used locally and shipped to out-of-state markets. In 1926 the total production of freestones amounted to 214,000 tons of which 155,000 tons were used for drying, 19,000 tons canned and 40,000 tons consumed locally and sent to out-of-state markets. It is estimated that by 1931 the bearing acreage of clingstone peaches will be about 23 per cent greater than the bearing acreage of 1927. The bearing acreage of freestone peaches will show very little change.

Apricots—There were 208,000 tons of apricots produced in California during 1927. This was the second largest crop ever produced. Furthermore, it was 32,000 tons above the production of 1926. Out of the 1927 crop, 57,000 tons were canned, 137,000 tons were used in drying and 14,000 tons shipped east or consumed within the state. From the 1926 crop 62,000 tons were canned, 103,000 were used for drying and 11,000 tons shipped east or consumed within the state. The crop north of the Tehachapi was very spotted due to injury caused by brown rot. In southern California a good crop was harvested, particularly in Ventura County. An increase of about 16 per cent is expected in the bearing acreage in the next four years.

Prunes—The 1927 prune crop amounted to 203,000 tons, which is 53,000 tons above the production of any previous year. The tonnage actually harvested was slightly under early season indications as the fruit dried out lighter than usual. Furthermore, some prunes of the smaller sizes were not harvested. From data on annual plantings it is expected that by 1931 the bearing acreage of prunes will be about 10 per cent above that of 1927.

Pears—California produced 181,000 tons of pears in 1927, of which about 89 per cent were Bartletts and 11 per cent fall and winter varieties. In 1926 there were 207,000 tons harvested of all varieties. In addition to the tonnage harvested in 1926 there were a few thousand tons wasted, largely on account of low prices and poor quality. There were 51,000 tons of pears canned from the 1927 crop, 98,000 tons shipped to out-of-state markets and 32,000 tons dried and consumed locally. This may be compared with 54,000 tons canned from the 1926 crop, 119,000 tons shipped out of the state and 34,000 tons dried and consumed locally. The tonnage actually harvested was slightly under early season forecasts because the fruit in some of the late maturing districts did not size up as usual. The bearing acreage of pears has been increasing at a fairly rapid rate and will continue to do so for some years to come because in 1927 the non-bearing acreage still made up about 37 per cent of the total acreage.

Plums—The tonnage of plums shipped from California the past season totalled 49,500 tons while in 1926 it amounted to 62,500 tons. Canners utilized only 2300 tons in 1927 compared with 3800 tons in 1926. The bearing acreage has been increasing yearly and it is estimated that by 1931 the acreage will be about 17 per cent larger than it was in 1927.

Cherries—The 1927 production of cherries was comparatively light and amounted to only 12,000 tons, of which approximately half were of the white or canning varieties and half black or shipping varieties. In 1926 the total production of all varieties amounted to 20,000 tons which is the heaviest crop ever produced. The tonnage canned in 1927 exclusive of cherries processed amounted to 2850 tons compared with 8775 canned in 1926. In 1927, 5400 tons were shipped to out-of-state markets while in 1926 the amount totalled 6900 tons. The bearing acreage of cherries has been increasing steadily and will continue to do so for the next four years.

Grapes—The total production of fresh grapes of all varieties in California in 1927 was 2,406,000 tons. Out of this total it was estimated that 2,264,000 tons were harvested and 142,000 tons left on the vines. In 1926, 2,129,000 tons were produced of which 15,000 tons were left on the vines. From 1919 to 1927 the bearing acreage of all grapes increased from 322,000 acres to 658,528 acres. Due to the fact that the plantings of grapes of raisin and table varieties have been light during the past two seasons, it is expected that the total bearing acreage of all grapes will be around 652,000 acres in 1930. This is about 6500 acres under the bearing acreage of the past season.

The total production of raisin grapes on a fresh basis was 1,443,000 tons. The consumption of raisin grapes in the fresh state amounted to 303,000 tons and about 1,140,000 tons were dried, producing an equivalent of 285,000 tons of raisins. Generally speaking the quality was good. There were, however, some raisins damaged by late fall rains. Plantings of raisin grapes have been very light the past two years and not large enough to maintain the present bearing acreage, so it is estimated that by 1930 the acreage will be about 332,000 compared with 346,985 acres the past season.

It was estimated that the total production of table grapes amounted to 490,000 tons, of which about 142,000 tons were not harvested. In 1926 only 15,000 tons were left unharvested out of a crop of 398,000 tons. Based on plantings, which have been very light during the past two years, it is expected that there will be a gradual decline in the bearing acreage of table grapes during the next three years.

From a check on the disposition of the crop it was estimated that the production of grapes of strictly wine varieties amounted to 473,000 tons. In 1926 it amounted to 414,000 tons. All varieties, particularly Alicantes and Zinfandels produced very heavy yields. The production of Alicantes has been increasing yearly as recent plantings have been largely of this variety. The bearing acreage of wine grapes is expected to continue to increase the next three years as plantings have been more than sufficient to maintain the present bearing acreage.

Oranges and Grapefruit—A final check on shipments of oranges from the 1926-27 crop plus the tonnage consigned to by-products factories and otherwise utilized, shows a total production of 28,167,000 boxes. This was the largest crop of oranges ever produced. The production of grapefruit amounted to approximately 650,000 boxes. Information available on the 1927-28 orange crop indicates that the total production will be about 22,500,000 boxes, while that of grapefruit will be about 720,000 boxes. A small increase in the bearing acreage of oranges is expected during the next four years. There will be a substantial increase in the bearing acreage of grapefruit as plantings have been quite heavy, particularly in the Imperial and Coachella valleys.

Lemons—The final estimate on the 1926-27 crop indicates that 7,712,000 boxes were shipped or sent to by-products factories and used locally. It is estimated that the 1927-28 crop will approximate 6,400,000 boxes. Little change is anticipated in the bearing acreage during the next four years.

Figs—Prospects during the early part of the season were very favorable but when the fruit became mature much of it was found to be affected with smut and rot, which was also the case in 1926. Due to regulations in force during the 1927 season the defects made it impossible to market more than 9286 tons, which is equivalent to about 77 per cent of the total crop. The unmarketable part of the crop was used locally for feed or by-products. The consumption of fresh figs is increasing yearly. Besides the local consumption which is quite heavy, there were 116 full car express shipments sent out of the state in 1927 compared with 85 in 1926 and 43 in 1925. The canned pack is also becoming more important due to the steady gain in the production of Kadotas. Last year approximately 3100 tons of figs of all varieties were canned. In 1926 the pack amounted to 2968 tons and in 1925, 1425 tons.

Olives—There were approximately 15,500 tons of olives harvested during 1927. This is about 3500 tons more than were harvested in 1926. About 10,000 tons of ripe olives were canned from the 1927 crop and about 3500 tons were used in the production of olive oil. The balance was shipped fresh, home-pickled, salt-cured and otherwise utilized. On the basis of recent plantings no increase in the bearing acreage is expected the next few years.

Almonds—The production of almonds amounted to 12,000 tons in 1927. The 1926 crop amounted to 16,000 tons, which is the largest produced. Yields varied a great deal during the past season as there was considerable damage from shothole fungus and brown rot.

Walnuts—California produced 48,500 tons of walnuts in 1927, which was considerably above the production of any previous year. This estimate includes not only the nuts sold in the shell but those diverted to cracking plants and those sold locally. Good yields were secured in all of the principal producing areas in the state. There has been a rapid increase in the bearing acreage and plantings during recent years have been heavy.

TABLE 16—*Production and Value of Specified Fruit Crops, 1923-1927*

Crop		Production	Unit	Farm value, December 1	
				Per unit	Total
Apples	1927	7,458,000	Bushels	$0 90	$6,712,000
	1926	10,350,000	Bushels	0 40	4,140,000
	1925	6,016,000	Bushels	1 15	6,918,000
	1924	8,903,000	Bushels	1 22	10,862,000
	1923	10,500,000	Bushels	0 75	7,875,000
5-year average (1923-27)		8,645,000	Bushels	0 84	7,301,000
Pears	1927	181,000	Tons	54 00	9,774,000
	1926	207,000	Tons	35 00	7,245,000
	1925	181,000	Tons	52 00	9,412,000
	1924	133,000	Tons	66 00	8,778,000
	1923	133,000	Tons	50 00	6,650,000
5-year average (1923-27)		167,000	Tons	50 13	8,372,000
Peaches	1927	[1]427,000	Tons	25 00	10,675,000
	1926	541,000	Tons	39 00	21,099,000
	1925	394,000	Tons	36 00	14,184,000
	1924	330,000	Tons	35 00	11,550,000
	1923	380,000	Tons	24 00	9,120,000
5-year average (1923-27)		414,400	Tons	32 16	13,326,000
Apricots	1927	208,000	Tons	57 00	11,856,000
	1926	176,000	Tons	63 00	11,088,000
	1925	150,000	Tons	54 00	8,100,000
	1924	142,000	Tons	46 00	6,532,000
	1923	210,000	Tons	25 00	2,250,000
5-year average (1923-27)		177,200	Tons	48 34	8,565,000
Prunes	1927	203,000	Tons	70 00	14,210,000
	1926	150,000	Tons	100 00	15,000,000
	1925	146,000	Tons	110 00	16,060,000
	1924	139,000	Tons	110 00	15,290,000
	1923	130,000	Tons	100 00	13,000,000
5-year average (1923-27)		153,600	Tons	95 78	14,712,000
Plums	1927	57,000	Tons	45 00	2,565,000
	1926	71,000	Tons	25 00	1,775,000
	1925	51,000	Tons	40 00	2,040,000
	1924	39,000	Tons	45 00	1,755,000
	1923	69,000	Tons	30 00	2,070,000
5-year average (1923-27)		57,400	Tons	35 56	2,041,000
Cherries	1927	12,000	Tons	180 00	2,160,000
	1926	20,000	Tons	180 00	3,600,000
	1925	12,000	Tons	160 00	1,920,000
	1924	13,500	Tons	140 00	1,890,000
	1923	17,000	Tons	160 00	2,720,000
5-year average (1923-27)		14,900	Tons	164 97	2,458,000
Raisins, dried	1927	285,000	Tons	60 00	17,100,000
	1926	272,000	Tons	70 00	19,040,000
	1925	200,000	Tons	80 00	16,000,000
	1924	170,000	Tons	70 00	11,900,000
	1923	290,000	Tons	45 00	13,050,000
5-year average (1923-27)		243,400	Tons	63 34	15,418,000
Raisin grapes (marketed fresh)	1927	303,000	Tons	23 00	6,969,000
	1926	229,000	Tons	20 00	4,580,000
	1925	[2]378,000	Tons	20 00	7,560,000
	1924	180,000	Tons	20 00	3,600,000
	1923	130,000	Tons	20 00	2,600,000
5-year average (1923-27)		244,000	Tons	20 75	5,061,000

[1] In addition it is estimated 65,000 tons of Cling tones were wasted.

[2] In addition it is estimated 142,000 tons were not harvested in 1927, compared with 15,000 tons in 1926 and 138,000 tons in 1925.

TABLE 16—*Production and Value of Specified Fruit Crops, 1923-1927*—Continued

Crop		Production	Unit	Farm value (December 1)	
				Per unit	Total
Grapes, table	1927	[illegible]	Tons	$26 [illegible]	$[illegible]
	1926	383,000	Tons	25 00	9,575,000
	1925	339,000	Tons	20 00	6,780,000
	1924	325,000	Tons	40 00	13,000,000
	1923	312,000	Tons	40 00	12,480,000
5-year average (1923-27)		341,400	Tons	29 81	10,177,000
[illegible]	1927	477,000	Tons	45 00	21,285,000
	1926	414,000	Tons	45 00	18,630,000
	1925	295,000	Tons	60 00	53,700,000
	1924	350,000	Tons	63 00	22,050,000
	1923	428,000	Tons	40 00	17,120,000
5-year average (1923-27)		412,000	Tons	49 90	20,557,000
Oranges and grapefruit	1927	23,220,000	Boxes	3 55	82,431,000
	1926	28,817,000	Boxes	3 05	87,892,000
	1925	24,880,000	Boxes	2 84	70,682,000
	1924	18,487,000	Boxes	3 55	65,629,000
	1923	24,300,000	Boxes	2 00	49,000,000
5-year average (1923-27)		23,965,000	Boxes	2 97	71,077,000
Lemons	1927	6,490,000	Boxes	3 50	22,400,000
	1926	7,712,000	Boxes	2 81	21,671,000
	1925	7,316,000	Boxes	2 11	15,057,000
	1924	5,125,000	Boxes	3 48	17,835,000
	1923	6,732,000	Boxes	1 60	10,771,000
5-year average (1923-27)		6,921,000	Boxes	2 65	17,547,000
Figs	1927	12,000	Tons	45 00	540,000
	1926	11,350	Tons	95 00	1,078,000
	1925	9,600	Tons	110 00	1,056,000
	1924	8,500	Tons	100 00	850,000
	1923	9,500	Tons	90 00	855,000
5-year average (1923-27)		10,200	Tons	85 95	876,000
Olives	1927	15,500	Tons	80 00	1,240,000
	1926	12,000	Tons	80 00	[illegible]
	1925	14,000	Tons	60 00	840,000
	1924	6,500	Tons	92 00	598,000
	1923	17,000	Tons	65 00	1,105,000
5-year average (1923-27)		13,000	Tons	71 97	[illegible]
Almonds	1927	12,000	Tons	320 00	3,840,000
	1926	16,000	Tons	300 00	[illegible]
	1925	7,500	Tons	400 00	3,000,000
	1924	8,000	Tons	300 00	2,400,000
	1923	11,000	Tons	260 00	2,860,000
5-year average (1923-27)		10,900	Tons	310 09	3,380,000
Walnuts	1927	48,500	Tons	360 00	17,460,000
	1926	15,000	Tons	480 00	[illegible]
	1925	36,000	Tons	440 00	15,840,000
	1924	22,500	Tons	460 00	10,350,000
	1923	25,000	Tons	400 00	10,000,000
5-year average (1923-27)		29,400	Tons	413 95	12,170,000

[1] In addition it is estimated 142,000 tons were not harvested in 1927, compared with 15,000 tons in 1926 and 138,000 tons in 1925.

FRESH FRUIT SHIPMENTS, DRIED FRUITS, CANNED FRUITS

Many inquiries are being received yearly relative to the shipment of fresh fruits out of the state; the tonnage of dried fruits and the pack of canned fruit. To properly answer such inquiries and also as a matter of record, the following tables have been prepared.

TABLE 17—*Interstate Shipments of California Deciduous Fruits in Carlots, 1895 to 1927, Inclusive*

(*All classes of equipment*)

Year	Apricots	Cherries	Figs	Grapes	Peaches	Pears	Plums	Miscellaneous	Total
1895[1]	162	180	.....	1,010	1,289	1,187	465	275	4,508
1896[1]	172	88	2	712	976	1,624	407	71	4,052
1897[1]	177	239	3	1,100	1,316	1,640	742	106	5,323
1898[1]	123	297	.....	734	1,103	1,595	542	613	5,007
1899[1]	90	85	.....	847	2,625	1,684	885	653	6,869
1900[1]	152	238	.....	825	1,361	2,115	1,158	586	6,435
1901[1]	201	110	.....	966	1,901	1,535	936	810	6,459
1902[1]	222	245	.....	1,033	1,777	2,011	1,473	375	7,136
1903[1]	241	211	.....	1,804	1,857	1,719	1,145	693	7,670
1904[1]	97	209	.....	1,451	559	2,186	1,053	71	5,626
1905[1]	279	79	.....	1,602	1,946	1,013	1,391	1,914	8,224
1906[1]	16	150	.....	2,052	584	1,513	1,220	770	6,305
1907[1]	71	98	.....	3,460	699	1,039	1,039	1,085	7,491
1908[1]	232	208	.....	3,816	1,980	2,702	1,763	15	10,716
1909[1]	208	250	.....	5,875	2,599	2,638	1,527	20	13,117
1910[1]	290	250	.....	4,948	2,518	2,361	1,552	17	11,936
1911[1]	223	216	.....	6,375	2,027	2,325	1,366	16	12,548
1912[1]	196	244	.....	6,358	1,621	3,135	1,775	15	13,344
1913[1]	170	231	.....	6,363	2,396	2,486	1,668	18	13,332
1914[1]	382	166	.....	8,773	2,144	2,725	1,907	49	16,146
1915[1]	392	205	.....	9,563	1,689	2,646	2,225	58	16,778
1916[1]	289	164	.....	9,722	1,910	3,701	1,999	106	17,891
1917[1]	403	330	.....	13,944	2,432	4,802	2,651	66	24,628
1918[1]	441	356	.....	16,358	3,137	4,572	2,483	75	27,422
1919[1]	419	335	.....	19,018	2,774	4,248	2,918	49	29,761
1920[1]	312	494	.....	24,280	3,148	4,391	2,564	241	35,430
1921	348	665	.....	30,200	3,453	4,384	3,113	257	42,420
1922	426	502	.....	41,118	2,361	5,799	3,498	183	53,887
1923	719	602	20	52,209	3,702	7,251	5,247	189	69,939
1924	510	711	21	58,448	1,838	5,781	2,882	204	70,395
1925	403	512	43	71,099	2,960	7,787	3,709	269	86,782
1926	264	741	85	60,786	1,619	9,891	5,221	293	78,900
1927	471	579	116	73,094	4,663	8,146	4,117	288	91,474

[1]Shipments from 1895 to 1920, inclusive, are from north of the Tehachapi only.

Table 17 presents data on the interstate shipments of deciduous fruit from California north of the Tehachapi, from 1895 to 1920, inclusive; and from all of California from 1921 to 1927, inclusive. Interstate shipments for southern California are not available prior to 1921. They were of minor importance before that time except for grapes and pears. Very few grapes, however, were shipped from southern California until 1918. The data for the early years were obtained from records compiled by the California Fruit News. The more recent data were supplied by the Pacific Fruit Express, Santa Fe Railway and the American Railway Express.

TABLE 18—*Estimated Production of Dried Fruits and Nuts, California*

Year	Apples, tons	Pears, tons	Peaches, tons	Apricots, tons	Prunes, tons	[1]Raisins, tons	Figs, tons	Almonds, tons	Walnuts, tons
1890	.....	300	.....	.....	8,000	19,000	.....	.....	.....
1891	1,400	500	6,600	6,750	13,750	26,000	180	.....	.....
1892	1,375	1,125	6,750	6,250	11,250	28,500	250	.....	.....
1893	1,900	1,320	8,400	4,750	26,090	42,500	450	.....	.....
1894	2,925	3,265	15,270	14,375	22,375	51,500	770	.....	.....
1895	2,280	2,700	12,250	5,325	32,375	45,500	1,375	.....	3,385
1896	1,175	4,825	8,230	3,370	27,600	34,000	1,080	.....	6,200
1897	2,625	3,175	13,575	15,067	48,890	47,000	1,625	.....	4,610
1898	1,760	3,310	5,480	4,120	45,210	40,500	2,390	450	5,650
1899	2,950	2,880	17,400	5,800	57,114	36,000	2,900	2,320	5,580
1900	3,180	7,275	17,170	14,040	87,000	47,000	3,000	2,740	5,430
1901	3,225	3,288	14,750	7,875	40,800	37,000	3,250	1,500	6,900
1902	4,875	2,625	25,200	18,750	98,500	54,000	3,600	3,270	8,570
1903	1,800	2,325	18,000	10,500	82,500	60,000	3,000	3,200	5,500
1904	1,500	1,750	11,500	8,500	67,500	40,000	2,850	800	7,590
1905	2,500	1,750	18,000	1,800	31,250	45,000	3,200	2,100	6,400
1906	2,500	1,500	10,000	3,000	92,500	50,000	3,000	750	7,000
1907	3,300	500	15,000	1,100	53,000	75,000	4,500	750	7,400
1908	3,350	2,500	23,000	19,000	28,500	65,000	2,900	2,900	9,200
1909	3,000	1,250	20,000	14,000	75,000	70,000	4,000	1,500	9,350
1910	3,000	1,000	25,000	15,250	40,000	62,500	3,775	3,300	9,600
1911	3,500	2,000	17,250	11,000	95,000	65,000	5,500	1,450	12,500
1912	3,600	1,750	29,000	20,000	102,500	95,000	5,000	3,000	11,250
1913	1,900	1,000	37,500	10,500	48,000	66,000	5,000	1,100	11,350
1914	4,500	1,500	35,100	20,500	56,000	91,000	6,500	2,250	8,900
1915	4,000	1,000	32,250	19,500	92,500	128,000	8,600	3,500	14,825
1916	4,500	800	28,000	11,000	78,500	132,000	9,900	3,400	14,600
1917	8,500	1,100	39,000	15,500	109,000	163,000	8,600	4,000	16,500
1918	6,250	1,000	20,000	15,000	45,000	167,000	9,200	5,100	19,950
1919	12,500	4,500	35,000	15,500	135,000	182,500	12,000	7,250	28,100
1920	5,500	2,700	27,000	9,500	97,250	177,000	12,300	5,500	21,000
1921	7,000	1,200	21,000	12,000	100,000	145,000	9,600	6,000	19,500
1922	10,500	5,000	28,000	15,500	110,000	237,000	11,000	8,500	27,000
1923	9,500	2,000	26,000	30,000	130,000	290,000	9,500	11,000	25,000
1924	10,000	3,150	24,500	16,000	139,000	170,000	8,500	8,000	22,500
1925	5,755	3,500	16,170	18,000	146,000	200,000	9,600	7,500	36,000
1926	10,500	4,250	28,200	18,800	150,000	285,000	11,350	16,000	15,000
1927	6,250	3,440	17,230	25,000	203,000	300,000	12,000	12,000	48,500

[1] Figures on raisins include all classes of dried grapes.

In Table 18 will be found estimates of the production of dried fruits and nuts. This table was prepared from data compiled by the Dried Fruit Association, California Packing Corporation, California Fruit News, and from the research studies of the economic status of certain California fruits by Messrs. Wellman and Shear of the College of Agriculture.

The figures on raisins not only include Muscats, Thompsons, Sultanas and Currants, but all other dried grapes as well, such as Malagas, Zinfandels, and Feher Szagos.

The following figures show the production of raisins from 1872 to 1889, which was impossible to list in Table 18.

Year	Production,[1] tons	Year	Production,[1] tons
1872	60	1881	900
1873	60	1882	1,150
1874	90	1883	1,400
1875	110	1884	1,750
1876	190	1885	5,000
1877	320	1886	7,000
1878	480	1887	8,000
1879	650	1888	9,630
1880	750	1889	9,870

[1] Source of data, Gustav Eisen, "The Raisin Industry."

TABLE 19.—*Comparative Packs of Canned Fruits—California—1895 to 1927, inclusive*

Cases	Apples, cases	Apricots, cases	Cherries, cases	Grapes, cases	Peaches, clingstone	Peaches, freestone	Pears, cases	Plums, cases	Total, cases
					ALL PEACHES				
1895[1]	29,131	407,000	98,061	32,373	708,600		263,483	145,515	1,684,163
1896[1]	22,859	339,189	69,056	33,488	692,146		347,681	111,786	1,616,205
1897[1]	35,213	368,758	149,383	38,029	861,874		360,618	133,747	1,947,622
1898[1]	54,128	493,918	172,376	32,999	860,981		402,220	131,989	2,148,611
1899[1]	104,409	847,456	53,709	55,972	1,293,657		555,211	164,515	3,074,929
1900	61,469	618,079	163,317	45,326	536,847	564,242	641,722	180,799	2,811,801
1901	61,416	378,859	63,008	50,886	879,259	683,281	489,899	155,269	2,761,877
1902	57,617	330,177	201,824	41,724	711,357	491,769	338,373	170,820	2,343,661
1903	58,843	748,155	211,119	63,898	651,528	485,971	461,249	147,095	2,827,858
1904	56,529	768,306	145,715	51,517	611,742	536,070	606,892	163,251	2,940,022
1905	70,749	713,895	74,886	47,620	978,675	924,505	498,812	72,555	3,381,697
1906	138,450	456,950	161,950	121,850	740,000	990,250	612,500	224,100	3,446,050
1907	145,100	388,450	148,715	145,875	715,025	1,039,585	573,700	170,010	3,326,460
1908	69,300	1,286,900	212,310	53,470	1,414,870	1,112,300	669,600	270,350	5,089,100
1909	132,575	764,560	205,280	28,835	998,245	692,500	536,350	103,400	3,461,745
1910	147,380	941,790	215,210	52,005	1,560,050	944,650	670,585	95,170	4,626,840
1911	121,850	1,008,150	221,320	79,715	1,494,925	894,600	657,880	188,330	4,666,770
1912	151,000	1,028,235	384,455	53,410	1,791,235	686,940	916,050	201,590	5,207,915
1913	60,765	982,790	175,115	48,115	1,751,100	1,014,025	571,350	79,180	4,682,440
1914	177,635	1,335,235	115,155	56,160	2,918,035	1,092,200	862,055	131,480	6,687,955
1915	81,620	981,190	182,750	77,610	2,407,650	831,875	827,630	95,215	5,485,540
1916	213,525	1,327,770	168,785	101,130	2,597,390	1,202,940	1,032,810	84,750	6,729,100
1917	271,538	2,356,553	440,134	85,491	3,607,568	1,554,393	758,142	270,052	9,343,871
1918	167,705	2,233,314	360,090	90,068	3,122,458	1,393,595	811,950	148,577	8,336,757
1919	134,245	4,395,204	460,614	104,446	5,096,249	1,962,700	1,071,687	280,261	13,505,406
1920	9,041	2,312,020	647,977	114,886	5,205,511	1,547,687	1,184,288	164,740	11,186,150
1921	98,500	1,150,514	222,772	91,886	4,162,849	1,633,418	872,396	141,348	8,373,683
1922	3,749	3,569,918	537,591	69,760	7,844,912	1,314,597	1,712,773	182,270	15,255,570
1923	22,697	1,562,298	590,685	54,210	6,591,335	872,676	1,181,565	164,402	11,039,868
1924		2,050,405	215,114	79,980	5,366,598	963,621	1,444,623	90,675	10,211,016
1925		2,196,680	222,816	130,269	9,258,587	1,198,314	2,315,600	178,910	15,501,176
1926		3,390,418	526,520	119,338	13,654,758	817,319	2,044,414	228,750	20,781,517
1927		3,116,713	170,909	140,652	10,829,681	320,812	1,929,805	137,163	16,645,735

[1] Figures from 1895 to 1905, inclusive, are calculated as no data on total packs by varieties are available.

In Table 19 is given the pack of canned fruits in California from 1895 to 1927, inclusive. This table was prepared from data compiled by the California Fruits News and the Canners' League of California. There were no data available on the total packs by varieties between 1895 and 1905. For those years the pack by varieties had to be calculated on a percentage basis and it is believed that the calculations represent fairly well the actual pack. The canned pack of the Pacific Northwest is becoming very important. Figures on the pack in that area as compiled by the Northwest Canners' Association will be found in Table 20.

TABLE 20—*Comparative Packs of Canned Fruits—Pacific Northwest (Oregon, Washington, Idaho)—1919 to 1927, inclusive*

Year	Apples, cases	Cherries, cases	Peaches, cases	Pears, cases	Plums, cases	Prunes, cases	Total, cases
1919	758,798	251,052	116	338,049	36,309	136,138	1,520,462
1920	352,758	353,861	----------	392,135	10,392	110,101	1,219,247
1921	948,135	211,783	----------	375,761	10,045	100,982	1,646,706
1922	632,656	357,596	1,190	833,521	15,860	263,341	2,104,164
1923	1,158,650	399,455	2,000	649,309	12,405	271,182	2,493,001
1924	1,171,250	380,632	1,144	751,290	23,127	115,516	2,442,959
1925	1,418,452	329,924	----------	1,275,844	36,300	269,242	3,329,762
1926	1,454,344	708,990	10,370	1,373,633	13,510	500,879	4,061,726
1927	1,237,038	359,114	----------	818,914	3,198	460,991	2,879,255

ESTIMATES OF CALIFORNIA FRUIT ACREAGES

The estimated acreage of California's major tree fruits for the 1928 season is 1,068,093 bearing and 211,887 acres non-bearing. Based on the acreage not yet in bearing, it is expected that there will be about 1,154,300 acres in bearing during 1931—an increase of 86,207 acres. For grapes the acreage for the 1928 season is 656,549 acres bearing and 18,399 acres non-bearing. The total bearing acreage of all classes of grapes is slightly on the decline as recent plantings have not been large enough to make up for removals.

Acreage estimates as given in Tables 24 to 31, inclusive, are segregated as to bearing and non-bearing relative to each county and for the state as a whole. The 1927 plantings of tree fruits are not included in the county totals of non-bearing acreage but are given in footnotes on each page. The different varieties of grapes have been arbitrarily arranged by classes in accordance with their general use rather than by considering the methods of disposal during recent years.

In Table 22 is shown the estimated bearing acreage of tree fruits in California, 1914 to 1928, inclusive, and the bearing acreage of grapes by classes, 1919 to 1928, inclusive.

The estimated acreage of clingstone and freestone peaches separately for 1928 by counties with the plantings for each class in 1927 is given in Table 33. The survey of the state's peach acreage by age and variety completed two years ago has been revised and continued, and the results for the state as a whole are given in Table 34. Similar information is given separately for northern, central and southern California in Tables 35 to 37, inclusive.

The survey completed last year of the state's pear acreage by age and variety has been revised and continued. The results are given in Table 38. During the past winter a similar survey was made of the apple acreage by age and variety in the important commercial areas. The results of this survey are given in Table 39.

TABLE 21—*Summary of California Tree Fruits and Grape Acreage Report, 1928*

	Total bearing acreage	Total nonbearing acreage	Nonbearing acreage exlusive of 1927 plantings	1927 plantings	Grand total acreage
Apples	57,396	6,725	6,153	572	64,121
Peaches (clingstone)	83,959	15,103	10,112	4,991	99,062
Peaches (freestone)	69,581	7,101	4,415	2,686	76,682
Pears	62,521	30,230	27,380	2,850	92,751
Apricots	85,314	14,818	12,546	2,272	100,132
Plums	34,875	6,676	5,979	697	41,551
Prunes	172,006	23,834	20,975	2,859	195,840
Cherries	12,641	5,762	4,783	979	18,403
Figs	50,513	11,691	8,322	3,369	62,204
Olives	25,903	4,061	3,754	307	29,964
Grapefruit	7,828	4,596	3,118	1,478	12,424
Lemons	42,864	2,667	2,216	451	45,531
Oranges	187,281	22,519	19,322	3,197	209,800
Almonds	92,159	9,644	8,570	1,074	101,803
Walnuts	83,252	46,460	41,688	4,772	129,712
Avocados	1,140	2,800	1,736	1,064	3,940
Pomegranates	1,570	108	87	21	1,678
Persimmons	879	2,040	1,845	195	2,919
Totals (tree fruits)	1,071,682	216,835	183,001	33,834	1,288,517
Wine grapes	173,691	13,900	8,682	5,218	187,591
Table grapes	141,133	3,367	1,897	1,470	144,500
Raisin grapes	341,725	1,132	733	399	342,857
Totals (grapes)	656,549	18,399	11,312	7,087	674,948
Grand totals (fruits and grapes)	1,728,231	235,234	194,313	40,921	1,963,465

TABLE 22—*Estimated Bearing Acreage of Tree Fruits in California, 1914 to 1928, inclusive. Estimated Bearing Acreage of Grapes in California, 1919 to 1928, inclusive*

	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
Apples	37,839	39,210	39,602	41,584	43,647	46,731	46,931	49,898	51,754	52,857	53,772	55,458	56,343	57,106	57,396
Peaches	115,028	114,175	114,034	113,918	107,575	103,378	103,200	100,861	106,229	109,011	111,828	119,255	126,130	141,936	153,540
Pears	16,246	18,029	18,039	20,228	22,416	23,056	29,366	31,434	37,681	40,962	43,125	46,773	51,993	56,515	62,521
Apricots	34,350	40,918	40,471	40,024	40,886	46,100	47,907	58,769	63,265	64,883	66,869	69,999	75,618	80,710	85,314
Plums	16,069	16,460	17,436	17,360	17,284	17,250	17,300	19,715	22,434	23,800	25,398	29,055	30,668	33,458	34,875
Prunes	82,933	91,470	101,190	102,278	103,000	104,000	105,000	106,269	111,383	119,429	128,704	138,753	155,978	165,161	172,006
Cherries	8,200	8,269	8,240	8,428	8,616	8,750	8,884	8,758	9,317	9,646	9,981	10,433	10,828	11,521	12,641
Figs	5,857	5,709	5,970	6,022	8,761	10,500	11,023	11,472	14,840	19,160	23,524	26,544	35,139	45,132	50,513
Olives	13,204	16,054	17,114	17,958	18,801	19,165	19,528	23,584	25,123	25,953	26,491	26,730	27,355	25,445	25,903
Grapefruit	766	916	1,200	1,600	2,000	2,568	3,109	3,642	3,935	4,067	4,205	4,379	4,972	6,223	7,828
Lemons	18,960	20,453	21,946	22,651	26,744	36,060	40,937	42,266	42,528	43,021	43,215	44,270	43,816	43,179	42,864
Oranges	107,281	112,926	113,729	123,821	130,971	145,000	162,000	171,928	175,415	176,800	177,978	181,341	184,060	185,891	187,281
Almonds	14,947	18,602	20,470	28,383	29,242	30,100	35,044	42,564	52,876	58,472	62,313	69,742	75,684	84,445	92,159
Walnuts	34,138	34,453	35,379	45,687	48,520	50,900	58,963	61,781	65,530	66,951	68,572	69,629	71,779	75,307	83,252
Totals (all tree fruits)[1]	505,818	537,644	554,820	589,942	608,463	643,558	689,192	732,941	782,310	815,012	845,975	892,361	950,363	1,012,029	1,068,093
Wine grapes						97,000	100,000	105,000	110,000	113,198	121,691	137,749	156,727	167,019	173,691
Table grapes						55,000	57,000	60,000	65,000	77,389	97,162	125,623	143,029	144,524	141,133
Raisin grapes						170,000	189,000	197,000	232,000	243,510	299,655	338,095	350,668	346,985	341,725
Totals (grapes)						322,000	346,000	362,000	407,000	434,097	518,508	601,467	650,424	658,528	656,549
Grand totals (fruits and grapes)[1]						965,558	1,035,192	1,094,941	1,189,310	1,249,109	1,364,483	1,493,828	1,600,787	1,670,557	1,724,642

[1] Avocados, pomegranates, persimmons not included.

In Table 23 is given a forecast of the bearing acreage of tree fruits for 1929, 1930 and 1931 and also a forecast of the bearing acreage of grapes for 1929 and 1930 in comparison with the estimated bearing acreage of tree fruits and grapes for 1928. This forecast of future bearing acreages is based upon an estimate of recent plantings that under normal conditions should come into bearing during the next three years. An allowance also has been made for the acreage that may be taken out as being no longer profitable.

TABLE 23.—*Forecast of Bearing Acreage of Tree Fruits, 1929, 1930 and 1931, and Grapes, 1929 and 1930*

	Estimated, 1928	Forecast, 1929	Forecast, 1930	Forecast, 1931
Apples	57,396	57,800	58,300	58,400
Peaches (clingstone)	83,959	87,400	89,000	91,700
Peaches (freestone)	69,581	69,000	68,000	67,500
Pears	62,521	68,700	74,300	80,400
Apricots	85,314	91,800	93,000	93,500
Plums	34,875	37,600	38,800	39,300
Prunes	172,006	177,900	181,000	182,100
Cherries	12,641	13,500	14,600	15,700
Figs	50,513	54,600	56,200	57,000
Olives	25,903	25,500	25,500	25,500
Grapefruit	7,828	8,800	9,750	10,200
Lemons	42,864	42,500	42,300	42,000
Oranges	187,281	189,000	191,000	192,000
Almonds	92,159	95,500	95,000	95,000
Walnuts	83,252	89,000	95,900	104,000
Totals (all tree fruits)[1]	1,068,093	1,108,600	1,132,650	1,154,300
Wine grapes	173,691	179,000	181,000	
Table grapes	141,133	140,000	139,000	
Raisin grapes	341,725	337,000	332,000	
Totals (grapes)	656,549	656,000	652,000	
Grand totals[1]	1,724,642	1,764,600	1,784,650	

[1] Avocados, pomegranates, persimmons not included.

TABLE 24—*Estimated Acreage of Apples, Peaches and Pears by Counties, 1928*

	Apples		All peaches		Pears	
	Bearing	*Non-bearing	Bearing	*Non-bearing	Bearing	*Non-bearing
The State	57,396	6,153	153,540	14,527	62,521	27,380
DISTRICT NO. 1—						
Del Norte					4	
Humboldt	884	44	90	9	187	150
Mendocino	1,275	250	174	40	1,797	3,173
DISTRICT NO. 2—						
Shasta	270	40	245	20	145	55
Siskiyou	167	26	34	4	32	12
Trinity					12	
DISTRICT NO. 3—						
Lassen	60		50		4	
Modoc	351	14	11		12	
Plumas	32				2	
DISTRICT NO. 4—						
Alameda	187	10	250	5	1,298	150
Contra Costa	617	19	1,681	107	3,459	1,402
Lake	270	33	65	63	4,620	3,418
Marin	70	5	60		182	79
Monterey	3,636	283	205		1,548	863
Napa	419	365	150	45	1,850	2,125
San Benito	191	21	896	208	1,280	648
San Luis Obispo	800	337	1,004	79	1,390	255
San Mateo	374	20	205	20	457	192
Santa Clara	1,077	319	2,949	546	5,721	1,690
Santa Cruz	14,378	949	165	60	837	763
Sonoma	13,546	1,462	317	23	2,373	710
DISTRICT NO. 5—						
Butte	548	134	4,150	654	678	92
Colusa	15	10	757	72	120	25
Glenn	71		1,086	369	491	75
Sacramento	150	21	4,040	501	7,582	2,142
Solano	128	25	2,407	316	3,678	553
Sutter	98	7	17,165	3,009	821	256
Tehama	350	25	2,156	508	316	52
Yolo	64	18	2,577	136	1,866	1,411
Yuba	30	15	3,593	566	725	364
DISTRICT NO. 5A—						
Fresno	1,200	20	17,870	767	230	20
Kern	960	15	907	127	1,075	5
Kings	38		4,858	242	10	
Madera	142		3,619	67	3	5
Merced	108	20	17,495	389	221	88
San Joaquin	70	10	6,000	371	1,833	1,159
Stanislaus	80	5	12,066	1,593	337	66
Tulare	1,049	251	12,016	1,843	217	471
DISTRICT NO. 6—						
Alpine					1	
Amador	120	12	183	1	72	2
Calaveras	174	10	74		62	1
El Dorado	450	112	500	120	2,939	956
Inyo	470	165	75	10	310	145
Mariposa	170	11	24		8	
Mono	51		2		19	
Nevada	300		150		1,411	24
Placer	482	12	9,123	369	3,999	1,327
Sierra	18				1	
Tuolumne	1,500	100	150	15	250	25
DISTRICT NO. 8—						
Imperial					43	
Los Angeles	992	95	6,536	337	4,086	1,429
Orange	225	91	31	41	50	33
Riverside	1,802	43	4,441	182	831	514
San Bernardino	5,785	46	9,309	460	645	195
San Diego	674	525	1,285	133	174	109
Santa Barbara	180	75	260	35	56	28
Ventura	298	83	84	65	151	123

*1927 plantings not included.
Estimated acreage planted in state, 1927: Apples, 572; peaches, 7,677; pears, 2,850.

TABLE 25.—*Estimated Acreage of Apricots, Plums and Prunes by Counties, 1928*

	Apricots		Plums		Prunes	
	Bearing	*Non-bearing	Bearing	*Non-bearing	Bearing	*Non-bearing
The State	85,314	12,546	34,875	5,979	172,006	20,975
DISTRICT NO. 1—						
Humboldt	50		135		100	70
Mendocino	48		7	5	1,299	149
DISTRICT NO. 2—						
Shasta	25	27	75		1,200	175
Siskiyou	7		10		40	
Trinity			7		7	
DISTRICT NO. 3—						
Lassen	14		2		2	
Modoc			13			
DISTRICT NO. 4—						
Alameda	3,350	176	100	50	1,800	200
Contra Costa	2,024	480	137	7	2,126	500
Lake	50	34		4	1,145	460
Marin	68	3	25		83	5
Monterey	2,178	300	45		554	
Napa	100	130	50	50	10,550	1,500
San Benito	5,058	225	50	8	6,977	825
San Luis Obispo	400	176	176	98	2,400	180
San Mateo	240	22	120	12	130	17
Santa Clara	16,846	2,002	1,450	113	65,585	3,476
Santa Cruz	1,700	50			1,025	130
Sonoma	25		550	86	23,862	3,217
DISTRICT NO. 5—						
Butte	125	30	280	5	8,250	133
Colusa	589	315	26		4,091	1,246
Glenn	1,119	242	23		3,434	769
Sacramento	500	283	3,250	800	3,148	809
Solano	3,600	408	4,661	388	5,220	344
Sutter	138	22	325	262	6,247	1,994
Tehama	575	138	42	21	3,291	892
Yolo	2,500	141	1,475	348	2,676	781
Yuba	99	18	35	20	910	1,182
DISTRICT NO. 5A—						
Fresno	2,600	245	3,150	600	1,699	128
Kern	1,527	193	917	233	260	45
Kings	3,200	250	100	100	750	
Madera	1,000	400	500	40	87	10
Merced	2,400	375	312	63	161	110
San Joaquin	1,176	127	1,850	100	1,625	450
Stanislaus	5,373	874	163	8	565	89
Tulare	4,124	99	5,129	1,088	9,059	797
DISTRICT NO. 6—						
Amador	9		225	5	134	31
Calaveras	23		17		76	
El Dorado			450	150	5	
Inyo	2		16	4	26	
Mariposa			27		10	
Nevada			268		4	
Placer	171	14	7,622	1,004	26	6
Tuolumne	2				13	
DISTRICT NO. 8—						
Imperial	40		5			
Los Angeles	3,611	341	583	111	38	73
Orange	181	2	13	1		
Riverside	5,700	1,335	10		775	20
San Bernardino	2,537	10	193	92	65	
San Diego	635	157	220	96	288	116
Santa Barbara	450	34	20			16
Ventura	9,125	2,868	16	7	188	30

TABLE 26—*Estimated Acreage of Cherries, Figs and Olives by Counties, 1928*

	Cherries		Figs		Olives	
	Bearing	*Non-bearing	Bearing	*Non-bearing	Bearing	*Non-bearing
The State	12,641	4,783	50,513	8,322	25,903	3,754
DISTRICT NO. 1—						
Humboldt	55	5				
Mendocino	83	16	10			
DISTRICT NO. 2—						
Shasta	30	12	30	10	75	1,250
Siskiyou	19	10				
DISTRICT NO. 3—						
Lassen	3					
Modoc	27					
DISTRICT NO. 4—						
Alameda	800	150	17			
Contra Costa	322	115	255	105	150	3
Lake	14	11	14	18	27	6
Marin	15	5	1		4	
Monterey	18	7				
Napa	300	273				
San Benito	35	12				
San Luis Obispo	39	44	44	22	10	
San Mateo	66	18	28	11	130	1
Santa Clara	3,176	866	40	83	50	
Santa Cruz	370	48		3		
Sonoma	1,282	175	27	3	183	10
DISTRICT NO. 5—						
Butte	95		300	43	4,075	510
Colusa			22	91	12	6
Glenn	7	3	825	80	606	
Sacramento	420	299	195	25	3,680	715
Solano	1,013	202	224	97	45	1
Sutter	345	201	161		90	
Tehama	85	112	103	217	713	250
Yolo	104	36	481	650	550	118
Yuba	12	101	131	49	890	142
DISTRICT NO. 5A—						
Fresno	105	10	17,412	2,000	1,261	200
Kern	11	10	129	134	953	
Kings		40	30		250	10
Madera			2,521	218	440	
Merced	15	37	11,958	1,667	295	31
San Joaquin	1,500	750	3,153	987	600	30
Stanislaus	114	54	2,801	141	405	11
Tulare	221	164	8,255	946	3,741	291
DISTRICT NO. 6—						
Amador	12	1				
Calaveras	5		13		123	10
El Dorado	120	142	9		5	
Inyo	10	3				
Mariposa			30			
Nevada	60		20			
Placer	587	196	67	2	352	26
Tuolumne	1	1	50	2		
DISTRICT NO. 8—						
Imperial			60		71	20
Los Angeles	16	31	616	388	1,545	1
Orange			3	12		
Riverside	452	448	94	141	1,225	105
San Bernardino	481	138	63	46	1,185	
San Diego	130	21	309	98	1,400	7
Santa Barbara	36	14	6	5	350	
Ventura	29	2	6	28	412	

*1927 plantings not included.

TABLE 27—*Estimated Acreage of Citrus Fruits by Counties, 1928*

	Grapefruit		Lemons		Oranges	
	Bearing	*Non-bearing	Bearing	*Non-bearing	Bearing	*Non-bearing
The State	7,828	3,118	42,864	2,216	187,281	19,322
NORTHERN CALIFORNIA—						
Butte					1,540	23
Colusa	25		720		48	4
Glenn	21		93		730	
Placer					235	
Sacramento	40		30		1,425	
Solano					14	
Tehama					22	4
Yolo					17	2
Yuba					43	
CENTRAL CALIFORNIA—						
Fresno	10		280	20	4,550	150
Kern	12	23	8		1,399	75
Merced					17	90
San Joaquin					130	1
Stanislaus			18	1	136	1
Tulare	1,181	4	2,688	11	36,306	268
SOUTHERN CALIFORNIA—						
Imperial	3,679	2,500			57	42
Los Angeles	512	46	11,520	224	40,427	3,256
Orange	93	51	6,531	597	39,003	10,055
Riverside	559	433	3,694		15,764	272
San Bernardino	1,543	26	5,434	20	39,452	659
San Diego	135	32	4,382	443	1,676	1,503
Santa Barbara	8		1,625	115	165	75
Ventura	10	3	5,841	785	4,125	2,842

*1927 plantings not included.
Estimated acreage planted in state, 1927: Grapefruit, 1,478; lemons, 451; oranges, 3,197.

TABLE 28—*Estimated Acreage of Oranges by Varieties, 1928*

	Navels		Valencias		Miscellaneous	
	Bearing	*Non-bearing	Bearing	*Non-bearing	Bearing	*Non-bearing
Los Angeles	16,054	549	23,700	2,699	673	8
Orange	982	9	37,938	10,046	83	
Riverside	12,093	222	3,182	50	489	
San Bernardino	29,196	411	9,433	248	823	
Tulare	26,265	192	9,572	24	469	52

*1927 plantings not included.

TABLE 29—*Estimated Acreage of Avocados, Persimmons and Pomegranates by Counties, 1928*

	Avocados		Persimmons		Pomegranates	
	Bearing	*Non-bearing	Bearing	*Non-bearing	Bearing	*Non-bearing
The State	1,140	1,736	879	1,845	1,570	87
DISTRICT No. 2—						
Shasta			5	65		
DISTRICT No. 4—						
Marin			1			
San Luis Obispo	10					
San Mateo			6	1	1	
DISTRICT No. 5—						
Butte					7	
Glenn	1		5	9		
Sacramento			50			
Sutter				71	25	
Tehama				30		
Yuba				15		
DISTRICT No. 5A—						
Fresno					20	
Kern			10	29	68	5
Kings				12		
Merced			8	14	19	6
Stanislaus			37	13	25	10
Tulare	8	1	85	148	1,268	47
DISTRICT No. 6—						
Placer			69	56		
DISTRICT No. 8—						
Imperial					87	13
Los Angeles	582	520	265	285		
Orange	210	419	162	523		
Riverside	11	7	13	250	15	
San Bernardino			18	45		
San Diego	318	747	102	230	35	5
Santa Barbara			36	9		
Ventura		42	7	40		1

*1927 plantings not included.

Estimated acreage planted in state, 1927: Avocados, 1,064; persimmons, 195; pomegranates, 21.

TABLE 30—*Estimated Acreage of Almonds, Walnuts and Total Acreages by Counties, 1928*

	Almonds		Walnuts		Total acreage all fruit and nut trees	
	Bearing	*Non-bearing	Bearing	*Non-bearing	Bearing	*Non-Bearing
The State	92,159	8,570	83,252	41,688	1,071,682	183,001
DISTRICT NO. 1—						
Del Norte					4	
Humboldt			75		1,576	278
Mendocino	11		100	30	4,804	3,663
DISTRICT NO. 2—						
Shasta	25		20	30	2,145	1,684
Siskiyou	6				315	52
Trinity					26	
DISTRICT NO. 3—						
Lassen					135	
Modoc					414	14
Plumas					34	
DISTRICT NO. 4—						
Alameda	200	20	100	99	8,102	860
Contra Costa	2,900	56	3,686	1,142	17,357	3,936
Lake	500	187	953	2,230	7,658	6,464
Marin	15	1	13		537	98
Monterey	4,003	51	91	67	12,278	1,571
Napa	43		150	405	13,612	4,893
San Benito	147	9	227	47	14,861	2,003
San Luis Obispo	28,209	4,734	392	159	34,874	6,084
San Mateo	28	7	170	10	1,955	331
Santa Clara	375	50	2,310	1,329	99,579	10,474
Santa Cruz					18,475	2,003
Sonoma	35	5	700	550	42,900	6,241
DISTRICT NO. 5—						
Butte	7,937	117	356	52	28,341	1,793
Colusa	6,421	116	142	425	12,988	2,310
Glenn	2,939	134	164	357	11,615	2,038
Sacramento	2,180	110	275	35	26,965	5,740
Solano	1,526	150	192	17	22,708	2,501
Sutter	2,260	37	571	708	28,246	6,567
Tehama	940	165	237	178	8,830	2,592
Yolo	10,830	1,451	150	101	23,290	5,193
Yuba	149	13	52	207	6,669	2,692
DISTRICT NO. 5A—						
Fresno	160	25	310	20	50,857	4,205
Kern	47	3	98	3	8,381	900
Kings	20		30	45	9,286	699
Madera	256	57			8,568	797
Merced	5,007	160	322	729	38,338	3,770
San Joaquin	5,900	200	5,025	1,000	28,862	5,185
Stanislaus	4,803	412	578	270	27,501	3,548
Tulare	1,010	65	1,796	487	88,153	6,981
DISTRICT NO. 6—						
Alpine					1	
Amador	21				776	52
Calaveras	40	30	40	5	648	56
El Dorado			35	20	4,513	1,500
Inyo					909	327
Mariposa					269	11
Mono					72	
Nevada			112		2,325	24
Placer	414	2			23,147	3,014
Sierra					19	
Tuolumne	1		100	25	2,067	168
DISTRICT NO. 8—						
Imperial					4,042	2,575
Los Angeles	603	73	26,372	8,562	98,304	15,772
Orange			12,478	373	58,980	12,198
Riverside	1,285	5	2,210	3,247	38,881	7,002
San Bernardino	15		2,838	6,737	69,563	8,474
San Diego	128	55	549	863	12,440	5,140
Santa Barbara	3		5,750	500	8,945	906
Ventura	707	70	13,483	10,624	34,542	17,613

*1927 plantings not included.

Estimated acreage planted in state, 1927: Almonds, 1,074; walnuts, 4,772; all fruit and nut trees, 33,834.

TABLE 31—*Estimated Acreage of Grapes by Classes and by Counties, 1928*

	Bearing			Non-bearing			Total
	Wine	Table	Raisin	*Wine	Table	Raisin	Bearing and non-bearing
The State	173,691	141,133	341,725	13,900	3,367	1,132	674,948
DISTRICT NO. 1—							
Humboldt	70						70
Mendocino	8,900			800			9,700
DISTRICT NO. 2—							
Shasta	180	75	60	70	7	15	407
Siskiyou	15	21					36
Trinity	5						5
DISTRICT NO. 3—							
Lassen	10						10
DISTRICT NO. 4—							
Alameda	3,800			250			4,050
Contra Costa	3,306	350	4	300	10		3,970
Lake	385			71			456
Marin	445			7			452
Monterey	230	80		6			316
Napa	10,710			340			11,050
San Benito	1,221			4			1,225
San Luis Obispo	838			135			973
San Mateo	165			15			180
Santa Clara	10,054			351			10,405
Santa Cruz	1,530	170		40			1,740
Sonoma	20,426			324			20,750
DISTRICT NO. 5—							
Butte	550	130		65	42		787
Colusa	216	76	2,057	170	5	79	2,603
Glenn	155	409	475	11			1,050
Sacramento	4,440	12,250	9	180	150		17,029
Solano	1,747	239		150			2,136
Sutter	966	162	8,540	1,233	215	60	11,176
Tehama	491	96	228	91	13	3	925
Yolo	1,742	1,207	1,780	362	26	58	5,175
Yuba	874	22	1,673	261		13	2,843
DISTRICT NO. 5A—							
Fresno	15,520	32,000	176,300	850			224,670
Kern	2,163	7,100	11,314	1,116	382	58	22,133
Kings	352	246	17,058	110		100	17,866
Madera	4,330	4,357	21,305	230	5	9	30,236
Merced	3,375	8,000	11,603	306	141	97	23,522
San Joaquin	24,892	33,692	725	296	101		59,706
Stanislaus	8,700	6,496	10,461	1,162	100	26	26,945
Tulare	2,006	19,381	62,283	806	1,315	215	86,006
DISTRICT NO. 6—							
Amador	20						20
Calaveras	324	102	19				445
El Dorado	447	54		11			512
Inyo	130	105					235
Mariposa	35						35
Nevada	150	40					190
Placer	3,749	1,651		137	12		5,549
Tuolumne	150	35	2	24	16		227
DISTRICT NO. 8—							
Imperial		4,500	1,800				6,300
Los Angeles	6,466	333		350	31		7,180
Orange	176			194			370
Riverside	2,088	1,930	1,069	2,481	500	158	8,226
San Bernardino	22,999	2,815	9,664	496	125	128	36,227
San Diego	1,993	2,040	3,296	70	48	113	7,560
Santa Barbara	155	130		22	10		317
Ventura		839			113		952

*There were approximately 2,000 acres of table grapes, mostly malagas, grafted to wine varieties in the spring of 1928, which are in addition to the non-bearing acreage of wine grapes as listed.

TABLE 32—*Estimated Acreage Planted to Grapes in 1926 and 1927*

	Planted, 1926			Planted, 1927		
	Wine	Table	Raisin	Wine	Table	Raisin
The State	8,682	1,897	733	5,218	1,470	399
DISTRICT NO. 1—						
Mendocino	300			500		
DISTRICT NO. 2—						
Shasta	30		15	40	7	
DISTRICT NO. 4—						
Alameda	200			50		
Contra Costa	200			100	10	
Lake	40			31		
Marin	5			2		
Monterey	4			2		
Napa	140			200		
San Benito	4					
San Luis Obispo	85			50		
San Mateo	8			7		
Santa Clara	244			107		
Santa Cruz	20			20		
Sonoma	74			250		
DISTRICT NO. 5—						
Butte	65	17			25	
Colusa	154	5	79	16		
Glenn	5			6		
Sacramento	130	50		50	100	
Solano	50			100		
Sutter	1,012		17	221	215	43
Tehama	26	3	3	68	10	
Yolo	250	14	28	112	12	30
Yuba	178		9	83		4
DISTRICT NO. 5A—						
Fresno	500			350		
Kern	840	238	22	276	144	36
Kings	60		100	50		
Madera	125	5	9	105		
Merced	203	90	47	103	51	50
San Joaquin	146	61		150	40	
Stanislaus	969	100	16	193		10
Tulare	478	967	105	328	348	110
DISTRICT NO. 6—						
El Dorado	5			6		
Placer	48	9		89	3	
Tuolumne	20	15		4	1	
DISTRICT NO. 8—						
Los Angeles	200	21		150	10	
Orange	194					
Riverside	1,381	117	158	1,100	383	
San Bernardino	250	75	78	246	50	50
San Diego	29	24	47	41	24	66
Santa Barbara	10	10		12		
Ventura		76			37	

TABLE 33—*Estimated Acreage of Peaches (Clingstone and Freestone) by Counties, 1928*

	Clingstone			Freestone		
	Bearing	*Non-bearing	1927 plantings	Bearing	*Non-bearing	1927 plantings
The State	83,959	10,112	4,991	69,581	4,415	2,686
DISTRICT No. 1—						
Humboldt	45	5		45	4	
Mendocino	87	20	10	87	20	10
DISTRICT No. 2—						
Shasta	50			195	20	30
Siskiyou	4			30	4	
DISTRICT No. 3—						
Lassen	25			25		
Modoc	6			5		
DISTRICT No. 4—						
Alameda	125	5		125		
Contra Costa	624	60	6	1,057	47	186
Lake	32	31		33	32	1
Marin	10			50		7
Monterey	10			195		5
Napa	20			130	45	25
San Benito	737	198	9	159	10	
San Luis Obispo	54	4		950	75	
San Mateo	102	10	20	103	10	15
Santa Clara	1,150	406		1,799	140	95
Santa Cruz	15	7		150	53	
Sonoma	124	11	10	193	12	
DISTRICT No. 5—						
Butte	2,450	560	75	1,700	94	
Colusa	395	27	23	362	45	8
Glenn	307	45		779	324	
Sacramento	3,320	391	132	720	110	27
Solano	78			2,329	316	105
Sutter	16,734	2,941	1,793	431	68	45
Tehama	153	144	14	2,003	364	66
Yolo	714	44	28	1,863	92	28
Yuba	3,566	561	329	27	5	
DISTRICT No. 5A—						
Fresno	4,820	601	60	13,050	166	75
Kern	185	25	15	722	102	118
Kings	1,298	52	50	3,560	190	100
Madera	1,523	44	15	2,096	23	5
Merced	10,583	177	173	6,912	212	254
San Joaquin	3,464	277	188	2,536	94	112
Stanislaus	8,794	1,402	378	3,272	191	185
Tulare	6,880	1,176	1,037	5,136	667	649
DISTRICT No. 6—						
Amador	42	1		141		
Calaveras	22			52		
El Dorado	125	86	12	375	34	13
Inyo	37	5		38	5	
Mariposa	12			12		
Mono	1			1		
Nevada	70			80		
Placer	2,785	268	107	6,338	101	155
Tuolumne	75	7	2	75	8	2
DISTRICT No. 8—						
Los Angeles	3,194	210	97	3,342	127	39
Orange	10	10		21	31	
Riverside	3,077	144	247	1,364	38	40
San Bernardino	5,908	115	156	3,401	345	264
San Diego	75	10	3	1,210	123	10
Santa Barbara				260	35	9
Ventura	42	32	2	42	33	3

TABLE 34—*Estimated Acreage of Peaches by Age and Variety for California, 1928*

Varieties	Total acreage by varieties	Number of acres of peach trees of each age					
		One year old	2 and 3 years old	4 and 5 years old	6 and 7 years old	8 and 9 years old	10 years old and over
Clingstones—							
Phillips	34,014	1,313	3,187	8,145	9,499	3,309	8,561
Tuscan	27,687	290	1,042	4,066	5,509	3,902	12,878
Paloro	11,614	1,350	2,538	5,087	2,412	216	11
Peak	5,945	512	1,042	1,783	2,044	472	92
Orange	3,101	5	99	183	485	256	2,073
Hauss	3,072	170	232	592	521	562	995
Levy	1,515	44	22	58	84	102	1,205
All other yellow clings	11,821	1,300	1,895	2,555	3,413	1,011	1,647
All other white clings	293	7	55	45	9	3	174
Total clingstones	99,062	4,991	10,112	22,514	23,976	9,833	27,636
Freestones—							
Muir	22,494	503	595	1,113	1,791	1,005	17,487
Elberta	22,018	700	1,448	3,375	2,715	799	12,981
Lovell	18,230	428	905	1,852	2,333	1,199	11,513
(Early and late)							
Crawfords	3,199	25	81	87	142	47	2,817
J. H. Hale	2,688	496	787	610	341	142	312
Salway	1,522	5	169	133	68	100	1,047
Alexander	687	45	49	26	43	29	495
Hale's Early	919	208	37	26	44	17	587
All other yellow frees	4,562	252	318	352	302	201	3,137
All other white frees	363	24	26	33	10	26	244
Total freestones	76,682	2,686	4,415	7,607	7,789	3,565	50,620
Total state	175,744	7,677	14,527	30,121	31,765	13,398	78,256

TABLE 35—*Estimated Acreage of Peaches by Age and Variety—Northern California, 1928*

Varieties	Total acreage by varieties	Number of acres of peach trees of each age					
		One year old	2 and 3 years old	4 and 5 years old	6 and 7 years old	8 and 9 years old	10 years old and over
Clingstones—							
Phillips	14,205	605	1,590	4,841	3,682	1,022	2,465
Tuscan	7,798	179	239	1,706	1,504	636	3,534
Paloro	4,442	596	1,186	2,136	524	.....	.....
Peak	2,076	267	509	907	376	5	12
Orange	433	.....	8	3	65	25	332
Hauss	2,448	20	186	512	341	477	912
Levy	1,175	24	20	53	51	88	939
All other yellow clings	6,215	842	1,393	2,045	885	238	812
All other white clings	18	.....	4	.....	.....	2	12
Total clingstones	38,810	2,533	5,135	12,203	7,428	2,493	9,018
Freestones—							
Muir	4,727	68	318	365	498	171	3,307
Elberta	7,135	252	619	821	597	291	4,555
Lovell	1,935	72	267	290	90	62	1,154
(Early and late)							
Crawfords	1,663	5	53	85	60	32	1,428
J. H. Hale	464	58	223	80	33	2	68
Salway	463	5	15	72	16	8	347
Alexander	166	2	23	26	20	11	84
Hale's Early	572	1	18	24	20	12	497
All other yellow frees	2,817	55	137	174	109	103	2,239
All other white frees	209	2	17	14	5	1	170
Total freestones	20,151	520	1,690	1,951	1,448	693	13,849
Total all peaches	58,961	3,053	6,825	14,154	8,876	3,186	22,867

NOTE.—Northern California includes the counties of Amador, Butte, Colusa, Del Norte, El Dorado, Glenn, Humboldt, Lake, Lassen, Marin, Mendocino, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, Shasta, Sierra, Siskiyou, Solano, Sonoma Sutter, Tehama, Trinity, Yolo, and Yuba.

TABLE 36—*Estimated Acreage of Peaches by Age and Variety—Central California, 1928*

Varieties	Total acreage by varieties	Number of acres of peach trees of each age					
		One year old	2 and 3 years old	4 and 5 years old	6 and 7 years old	8 and 9 years old	10 years old and over
Clingstones—							
Phillips	15,568	467	1,464	3,036	5,150	1,685	3,766
Tuscan	14,128	81	619	2,033	2,949	2,252	6,194
Paloro	6,723	615	1,279	2,752	1,850	216	11
Peak	3,629	220	512	824	1,629	365	79
Orange	2,458	5	91	176	420	229	1,537
Hauss	594	150	20	76	180	85	83
Levy	300	20	2	4	33	14	227
All other yellow clings	3,288	391	418	225	1,540	377	337
All other white clings	232	4	51	45	9	-------	123
Total clingstones	46,920	1,953	4,456	9,171	13,760	5,223	12,357
Freestones—							
Muir	16,498	435	276	748	1,283	821	12,935
Elberta	13,282	422	759	2,531	1,960	431	7,179
Lovell	11,205	353	479	1,297	1,618	517	6,941
(Early and late)							
Crawfords	1,372	20	7	2	82	15	1,246
J. H. Hale	1,138	343	171	305	110	59	150
Salway	521	-------	137	38	22	10	314
Alexander	489	43	15	-------	20	-------	411
Hale's Early	162	30	14	2	24	5	87
All other yellow frees	1,037	150	126	139	160	18	444
All other white frees	90	5	9	19	5	-------	52
Total freestones	45,794	1,801	1,993	5,081	5,284	1,876	29,759
Total all peaches	92,714	3,754	6,449	14,252	19,044	7,099	42,116

NOTE.—Central California includes the counties of Alameda, Alpine, Calaveras, Contra Costa, Fresno, Inyo, Kern, Kings, Madera, Mariposa, Merced, Mono, Monterey, San Benito, San Joaquin, San Luis Obispo, San Mateo, Santa Clara, Santa Cruz, Stanislaus and Tuolumne.

TABLE 37—*Estimated Acreage of Peaches by Age and Variety—Southern California, 1928*

Varieties	Total acreage by varieties	Number of acres of peach trees of each age					
		One year old	2 and 3 years old	4 and 5 years old	6 and 7 years old	8 and 9 years old	10 years old and over
Clingstones—							
Phillips	4,240	241	133	268	667	602	2,329
Tuscan	5,761	30	184	327	1,056	1,014	3,150
Paloro	449	139	73	199	38	-------	-------
Peak	240	25	21	52	39	102	1
Orange	210	-------	-------	4	-------	2	204
Hauss	30	-------	26	4	-------	-------	-------
Levy	40	-------	-------	1	-------	-------	39
All other yellow clings	2,318	67	84	285	988	396	498
All other white clings	43	3	-------	-------	-------	1	39
Total clingstones	13,331	505	521	1,140	2,788	2,117	6,260
Freestones—							
Muir	1,269	-------	1	-------	10	13	1,245
Elberta	1,601	26	70	23	158	77	1,247
Lovell	5,090	3	159	265	625	620	3,418
(Early and late)							
Crawfords	164	-------	21	-------	-------	-------	143
J. H. Hale	1,086	95	393	225	198	81	94
Salway	538	-------	17	23	30	82	386
Alexander	32	-------	11	-------	3	18	-------
Hale's Early	185	177	5	-------	-------	-------	3
All other yellow frees	708	47	55	39	33	80	454
All other white frees	64	17	-------	-------	-------	25	22
Total freestones	10,737	365	732	575	1,057	996	7,012
Total all peaches	24,068	870	1,253	1,715	3,845	3,113	13,272

NOTE.—Southern California includes the counties of Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, Santa Barbara and Ventura.

TABLE 38—*Estimated Acreage of Pears by Age and Variety, 1928*

Variety	1927 plantings	2 years old	3 years old	4 years old	5 years old	6 years old	7 years old	8 years old	9 years old
Bartlett	2,135	4,250	5,092	4,886	5,269	5,578	5,199	4,844	3,283
Beurre Anjou	23	30	66	33	107	44	68	56	30
Beurre Hardy	146	387	478	363	463	334	78	129	29
Beurre Bosc	204	227	448	272	200	152	116	143	43
Beurre Clairgeau	5	17	5	43	109	114	48	69	13
Comice	43	50	10	19	77	48	36	53	15
Easter Beurre	78	134	203	125	167	52	13	41	6
Winter Nelis	157	191	241	299	302	330	183	150	91
All others	59	115	107	123	100	118	49	68	20
Totals, fall and winter varieties	715	1,151	1,558	1,277	1,525	1,192	591	709	247
Grand totals	2,850	5,401	6,650	6,163	6,794	6,770	5,790	5,553	3,530

TABLE 38—*Estimated Acreage of Pears by Age and Variety, 1928*—Continued

Variety	10 years old	11 years old	12 years old	13 years old	14 to 18 years	19 to 23 years	24 to 28 years	29 years and over	Totals by varieties
Bartlett	3,285	4,041	4,706	4,637	10,233	2,907	1,959	8,450	80,754
Beurre Anjou	58	51	85	80	154	-------	1	20	906
Beurre Hardy	47	45	81	4	23	11	1	43	2,662
Beurre Bosc	30	18	77	24	41	-------	-------	4	1,999
Beurre Clairgeau	23	18	26	68	75	11	-------	85	729
Comice	47	13	118	37	175	2	5	7	755
Easter Beurre	-------	-------	4	1	37	7	-------	41	909
Winter Nelis	51	121	116	62	260	50	39	154	2,797
All others	33	20	86	55	88	54	14	131	1,240
Totals, fall and winter varieties	289	286	593	331	853	135	60	485	11,997
Grand totals	3,574	4,327	5,299	4,968	11,086	3,042	2,019	8,935	92,751

TABLE 39—*Estimated*[1] *Acreage of Apples by Age and Variety, 1928*

Variety	1927 plantings	2 years old	3 years old	4 years old	5 years old	6 years old	7 years old	8 years old	9 years old
Newton pippin	58	82	51	102	263	192	125	22	.....
Gravenstein	103	144	155	222	401	438	314	305	232
Bellefleur	.....	1	.....	24	25	.....	.....	.....	.....
Delicious	60	62	93	183	77	27	23	99	.....
Rome Beauty	.....	33	.....	1	14	28	12	62	.....
Winesap	5	3	3	3	3	8	8	.....	.....
W. W. Pearmain	.....	106	36	9	31	26	14	134	24
Jonathan	5	9	24	19	11	7	3	6	1
Spitzenburg	.....	.....	2	5	2	23	.....	2	5
Winter Banana	8	2	129	37	36	4	60	70	.....
Red Pearmain	.....	.....	.....	.....	.....	.....	.....	.....	.....
Smith's Cider	.....	20	20	9	23	20	9	17	.....
All others	7	3	1	29	165	21	50	35	5
Totals	246	465	514	643	1,051	794	618	752	267

TABLE 39—*Estimated*[1] *Acreage of Apples by Age and Variety, 1928*—Continued

Variety	10 years old	11 years old	12 years old	13 years old	14 to 21 years	22 to 31 years	32 to 41 years	42 years and over	Totals by varieties
Newton Pippin	.....	3	.....	187	4,780	4,660	2,185	875	13,585
Gravenstein	196	518	440	857	6,730	1,453	326	148	12,982
Bellefleur	.....	1	.....	130	1,776	1,443	640	189	4,229
Delicious	.....	8	47	258	1,541	41	7	9	2,535
Rome Beauty	11	.....	117	211	1,818	41	9	5	2,362
Winesap	.....	.....	22	415	1,159	60	10	33	1,732
W. W. Pearmain	.....	.....	46	6	516	318	12	7	1,285
Jonathan	31	22	.....	55	738	66	19	9	1,025
Spitzenburg	12	.....	.....	7	193	100	28	110	489
Winter Banana	5	.....	46	4	60	7	8	.....	476
Red Pearmain	.....	.....	.....	.....	62	338	10	.....	410
Smith's Cider	.....	.....	.....	.....	54	206	.....	.....	378
All others	28	5	114	215	1,176	607	232	175	2,868
Totals	283	557	832	2,345	20,603	9,340	3,486	1,560	44,356

[1]The above acreage survey covers only Napa, Sonoma, Monterey, Santa Cruz, Santa Clara, San Bernardino and Riverside counties. These seven counties have 69 per cent of the state's acreage, and in an average year produce about 85 per cent of its production.

LIVE STOCK REVIEW—1927

Pastures and Ranges—Pastures and ranges in California generally furnished satisfactory feed during 1927, the monthly condition for the state as a whole exceeding the 5-year average. During spring and early summer months pastures were exceptionally good, and the bulk of market lambs and cattle were in fine condition. Northeastern counties were drier than usual during early spring and late fall, and lack of rainfall resulted in some unsatisfactory pasture conditions in southern California, part of the San Joaquin Valley, and in some coastal areas.

Cattle—Cattle were maintained in good shape generally throughout 1927, being particularly good during the period of heavy marketing off pastures. The cattle situation was featured by substantial increases in prices and by keen demand for all classes. Beef producers generally made the first substantial profits in seven years. Marketings of cattle were again heavy, numerous localities finding it necessary or desirable to make something of a clean-up. However, total inspected slaughter of cattle and calves for 1927 in the state was less than for 1926, calf slaughter showing the greater proportionate decrease. Imports of all cattle and calves in 1927 from outside states were larger than for any of the past six years. There was a good calf crop in 1927, which, with heavier imports and decreased slaughter, resulted in a slight increase in total cattle numbers at the end of the year. California is the only state west of the "Plains" area that registered an increase in total cattle and calves during 1927.

The number of milk cows in the state increased slightly during 1927. Dairy farmers generally in the state had a favorable year, both as to production and prices. Available records on production indicate steady increases in average production per cow. Prices for milk cows continue to advance.

Sheep and Lambs—California sheepmen enjoyed a very favorable year in 1927. The lamb crop was again large, feed conditions mostly favorable, and prices for lambs and wool such as to return profits. The shipments of early lambs to eastern markets exceeded all previous records. Imports of sheep and lambs during 1927 were a little larger than in 1926, and much in excess of importations for any of the four previous years. Inspected slaughter was slightly less than in 1926, but larger than in 1925. Sheep numbers registered an increase of 4 per cent during 1927, with indications pointing to some further gradual expansion, so long as the sheep business returns profits to growers.

Hogs—The hog population of the state showed a further gain of 5 per cent during 1927, the rapid expansion which was in evidence the previous year being sharply checked by lower prices. Some further increase in California hog production is indicated by the Pig Surveys. California now imports well over 600,000 live hogs annually, besides much pork and pork products. The state produces less than half of its requirements of pork and pork products. Inspected hog slaughter for 1927 in California was materially heavier than in 1925 or 1926, but less than in 1923 and 1924.

Horses and Mules—The number of horses in California continued to decrease. Prices and demand for horses are not sufficient to stimulate breeding, and some further decreases in number are probable. Mule numbers remain about constant.

ESTIMATED VALUE OF THE PRODUCTION OF CALIFORNIA LIVE STOCK—1927

Annual estimates of the value of production of cattle, hogs, and sheep, are now being made by the Division of Crop and Live Stock Estimates. Such estimates are based upon all available data relating to slaughter, in-shipments, out-shipments, deaths, changes in inventory numbers, monthly prices, etc. These estimates for California covering the year 1927 are presented below. They represent the gross farm value of live stock sold off farms and ranges during the year, and the value of animals slaughtered on farms. Similar estimates for previous years are not available.

Comparable estimates covering the value of dairy and poultry products are not being compiled by this Division, owing to lack of funds necessary to collect current basic data. However, in order to indicate the relative importance of these industries in the state, there are included the estimates of the value of all butterfat sold in 1927, as compiled by the Bureau of Dairy Control, State Department of Agriculture, and the value of chickens raised and eggs produced, as shown by the Agricultural Census of 1925.

VALUE OF LIVE STOCK PRODUCTION IN 1927

Cattle and Calves	$26,419,000
Sheep, Lambs and Wool	21,395,000
Hogs	15,264,000
Value of all butterfat sold from farms—1927	*$4,807,000
Value of chickens raised and eggs produced—1924	**44,424,000

*Data furnished by Bureau of Dairy Control.
**Bureau of the Census, 1925.

LIVE STOCK ESTIMATES

HORSES AND MULES

The number of horses in California on January 1, 1928, shows a decrease of about 2 per cent when compared with the previous year; while there was no change in the estimated number of mules.

In Table 41 is shown the estimated number of horses and mules by counties on January 1, 1926 to 1928, inclusive.

In Table 47 is given the estimated number, value per head and total value of horses and mules on farms in California and the United States on January 1, 1920 to 1928, inclusive.

The total number of horses and mules in the state; the values per head of different ages; and the total value as of January 1, for 1926 to 1928, inclusive, are given in Table 40.

TABLE 40—*Numbers and Values of Horses and Mules as of January 1, 1926-1928*

	1926	1927	1928
Horses (value per head)—			
Under 1 year	$27 00	$27 00	$27 00
1 to 2 years	43 00	44 00	43 00
2 years and over	78 00	78 00	76 00
All ages	76 00	76 00	73 00
Total number	302,000	295,000	290,000
Total value	$22,938,000	$22,313,000	$21,302,000
Mules (value per head)—			
Under 1 year	$32 00	$32 00	$32 00
1 to 2 years	49 00	49 00	47 00
2 years and over	97 00	94 00	89 00
All ages	92 00	89 00	83 00
Total number	54,000	53,000	53,000
Total value	$4,964,000	$4,723,000	$4,420,000

TABLE 41—*Estimated Number of Horses and Mules on Farms, January 1, 1926-1928*

Counties	Horses			Mules		
	1926	1927	1928	1926	1927	1928
DISTRICT No. 1—						
Del Norte	500	500	500	15	15	15
Humboldt	5,600	5,500	5,500	280	280	280
Mendocino	4,000	3,900	3,900	400	390	390
DISTRICT No. 2—						
Shasta	4,000	3,000	3,900	320	320	320
Siskiyou	5,900	5,900	5,900	440	440	440
Trinity	900	800	800	130	130	130
DISTRICT No. 3—						
Lassen	6,000	6,000	6,000	980	980	980
Modoc	8,400	8,300	8,200	900	900	900
Plumas	1,300	1,300	1,300	60	60	60
DISTRICT No. 4—						
Alameda	5,700	5,700	5,600	100	100	100
Contra Costa	5,500	5,500	5,400	400	400	400
Lake	1,600	1,600	1,500	240	240	240
Marin	2,300	2,300	2,300	80	80	80
Monterey	10,300	9,800	9,800	860	860	860
Napa	2,900	2,900	2,800	260	260	260
San Benito	3,600	3,500	3,400	30	30	30
San Luis Obispo	9,400	9,200	9,000	580	540	540
San Mateo	2,500	2,500	2,400	50	50	50
Santa Clara	8,400	8,300	8,200	380	380	380
Santa Cruz	2,800	2,700	2,600	80	80	80
Sonoma	9,100	9,000	9,000	400	390	390
DISTRICT No. 5—						
Butte	4,400	4,200	4,100	600	600	600
Colusa	2,600	2,400	2,400	2,000	1,900	1,900
Glenn	3,400	3,400	3,200	1,600	1,500	1,500
Sacramento	8,000	7,800	7,600	500	500	500
Solano	4,300	4,200	4,100	950	940	940
Sutter	3,100	3,000	3,000	830	830	830
Tehama	4,800	4,500	4,500	1,500	1,500	1,500
Yolo	5,600	5,500	5,400	1,450	1,450	1,450
Yuba	2,400	2,300	2,200	320	320	320
DISTRICT No. 5A—						
Fresno	18,500	18,000	17,600	4,800	4,900	4,900
Kern	9,000	9,000	8,800	2,500	2,300	2,300
Kings	6,700	6,800	6,600	1,400	1,300	1,300
Madera	4,200	4,000	4,000	2,140	2,100	2,100
Merced	8,000	8,100	7,700	1,940	1,900	1,900
San Joaquin	14,000	13,500	13,300	1,400	1,300	1,300
Stanislaus	10,000	9,500	9,400	1,600	1,600	1,600
Tulare	15,000	15,000	14,600	4,200	4,200	4,200
DISTRICT No. 6—						
Alpine	150	150	150	5	5	5
Amador	1,100	1,100	1,100	55	55	55
Calaveras	1,700	1,600	1,600	50	50	50
El Dorado	1,800	1,700	1,700	100	90	90
Inyo	2,800	2,100	2,100	580	450	450
Mariposa	1,200	1,100	1,100	280	260	260
Mono	900	900	800	70	60	60
Nevada	900	900	900	40	40	40
Placer	3,100	3,000	3,000	300	300	300
Sierra	550	550	550	20	15	15
Tuolumne	1,600	1,400	1,400	90	80	80
DISTRICT No. 8—						
Imperial	9,900	9,800	9,600	3,800	3,800	3,800
Los Angeles	10,200	10,000	9,800	1,800	1,700	1,700
Orange	4,400	4,200	4,200	2,600	2,400	2,400
Riverside	8,400	8,400	8,200	2,300	2,200	2,200
San Bernardino	5,900	5,800	5,700	1,350	1,450	1,450
San Diego	7,700	7,500	7,400	1,200	1,300	1,300
Santa Barbara	7,800	7,500	7,400	350	350	350
Ventura	7,200	7,000	6,800	2,400	2,350	2,350
State	302,000	295,000	290,000	54,105	53,020	53,020

MILK COWS AND ALL OTHER CATTLE

The Federal Census of 1920 enumerated 2,008,000 cattle in California. This number gradually increased to 2,142,000 on January 1, 1924. The following two years, liquidation was heavy with a consequent decrease in numbers but the past two years show a steady increase in the estimated number of cattle on California farms and ranches.

In Table 47 is given the estimated number, value per head, and total value of milk cows, 2 years old and over, and all other cattle on farms and ranges in California and the United States on January 1, 1920 to 1928, inclusive.

In Table 43 is shown the estimated number of milk cows, 2 years old and over, and all other cattle by counties on January 1, 1926 to 1928, inclusive.

The total number of milk cows, 2 years old and over; all other cattle; and all cattle and calves; the value per head and the total value as of January 1, 1926 to 1928, inclusive, are given in Table 42.

TABLE 42—*Numbers and Values of Milk Cows, All Other Cattle, and All Cattle and Calves as of January 1, 1926-1928*

	1926	1927	1928
Milk cows (value per head)	$77 00	$78 00	$83 00
Total number	596,000	596,000	602,000
Total value	$45,892,000	$46,488,000	$49,966,000
All other cattle (value per head)	$35 16	$37 00	$42 80
Total number	1,322,000	1,360,000	1,393,000
Total value	$46,480,000	$50,316,000	$59,617,000
All cattle and calves—including cows and heifers kept for milk (value per head)	$48 20	$49 50	$54 90
Total number	1,918,000	1,956,000	1,995,000
Total value	$92,372,000	$96,804,000	$109,583,000

TABLE 43—*Estimated Number of Milk Cows and All Other Cattle on Farms, January 1, 1926-1928*

Counties	Milk cows 2 years old and over			All other cattle		
	1926	1927	1928	1926	1927	1928
DISTRICT No. 1—						
Del Norte	4,700	4,600	4,600	3,400	3,500	3,500
Humboldt	26,500	26,000	25,500	56,000	56,800	56,800
Mendocino	8,300	8,200	8,100	21,000	21,200	21,200
DISTRICT No. 2—						
Shasta	3,400	3,600	3,500	33,000	33,000	33,000
Siskiyou	8,200	8,400	8,600	43,500	43,500	44,000
Trinity	500	500	500	12,400	12,400	12,400
DISTRICT No. 3—						
Lassen	3,200	3,300	3,100	30,000	31,000	31,000
Modoc	3,900	4,100	4,200	59,700	60,000	60,000
Plumas	2,400	2,400	2,600	6,000	6,100	6,200
DISTRICT No. 4—						
Alameda	11,500	11,000	11,500	20,000	21,000	21,000
Contra Costa	6,800	7,000	7,000	18,000	19,000	19,500
Lake	2,000	2,100	2,100	5,200	5,200	5,200
Marin	26,000	25,000	25,500	11,000	10,800	10,800
Monterey	21,000	21,500	21,600	42,000	42,500	43,000
Napa	4,800	5,000	5,500	9,500	9,400	9,400
San Benito	3,100	2,900	3,000	23,000	24,500	26,000
San Luis Obispo	21,000	20,000	20,000	58,000	59,500	61,000
San Mateo	9,400	9,200	9,500	6,000	5,800	5,800
Santa Clara	12,400	12,400	13,000	27,500	28,000	28,000
Santa Cruz	3,500	3,300	3,500	4,100	4,200	4,100
Sonoma	27,000	26,000	27,000	17,000	17,600	17,000
DISTRICT No. 5—						
Butte	6,000	5,800	6,000	18,600	19,200	19,500
Colusa	3,600	3,500	3,500	14,500	14,600	14,600
Glenn	8,200	8,300	8,400	16,500	16,800	17,000
Sacramento	11,000	10,500	11,000	16,200	17,500	18,000
Solano	7,500	7,600	7,800	9,300	9,600	10,000
Sutter	4,600	4,600	5,000	5,600	5,600	5,500
Tehama	4,200	4,000	4,000	36,000	37,000	37,500
Yolo	9,400	9,200	9,500	13,400	14,000	14,000
Yuba	3,100	3,200	3,200	12,600	12,200	12,200
DISTRICT No. 5A—						
Fresno	25,000	25,000	26,000	70,500	72,000	73,000
Kern	10,800	10,700	11,000	108,000	112,000	113,000
Kings	21,200	22,500	23,000	18,800	19,800	22,000
Madera	6,700	6,500	6,700	21,700	23,000	24,000
Merced	36,500	37,800	37,600	33,000	36,000	38,000
San Joaquin	26,500	27,600	28,000	23,500	25,000	26,000
Stanislaus	38,500	39,000	39,000	33,000	34,000	36,000
Tulare	31,500	32,500	32,600	72,000	75,000	81,000
DISTRICT No. 6—						
Alpine	300	300	300	2,000	2,000	2,000
Amador	1,300	1,100	1,000	12,200	13,000	13,500
Calaveras	1,300	1,300	1,100	20,300	21,000	21,500
El Dorado	2,500	2,500	2,200	10,000	10,400	10,800
Inyo	1,700	1,200	1,000	9,500	8,500	8,500
Mariposa	300	300	300	12,000	12,000	13,000
Mono	300	300	300	8,500	8,500	9,000
Nevada	1,800	1,700	1,500	5,100	5,200	5,500
Placer	2,500	2,200	2,200	4,500	4,500	4,500
Sierra	1,400	1,400	1,300	4,500	4,500	4,500
Tuolumne	1,000	1,000	800	13,500	14,300	14,500
DISTRICT No. 8—						
Imperial	29,000	27,000	25,000	48,000	52,000	55,000
Los Angeles	38,500	39,000	40,000	13,500	13,200	13,500
Orange	7,200	7,100	8,000	10,200	10,400	11,000
Riverside	9,500	10,200	10,000	12,800	13,200	14,000
San Bernardino	11,000	12,200	12,600	26,800	27,500	28,000
San Diego	11,000	11,000	11,000	36,600	37,500	39,000
Santa Barbara	8,300	8,200	8,100	30,500	32,000	33,000
Ventura	3,200	3,200	3,100	12,000	12,000	12,000
State						

SHEEP AND SWINE

The estimated number of sheep in California on January 1, 1920, was 2,900,000. During the deflation years of 1920 and 1921 sheep decreased in number to 2,475,000. Since January 1, 1922, there has been a gradual increase to a total of 3,528,000 on January 1, 1928.

Texas is now the only state outranking California in the estimated number of sheep, but owing to a higher value per head, the total value of all sheep and lambs on farms and ranges in California is nearly one million dollars greater than in Texas.

In Table 47 is shown the estimated number, value per head and total value of sheep and lambs on farms and ranges in California and the United States on January 1, 1920 to 1928, inclusive.

In Table 45 is given the estimated number of sheep and swine on farms by counties on January 1 for the past three years.

The total number of sheep and swine, the values per head for different ages or sex and the total value as of January 1, 1926 to 1928, inclusive, are given in Table 44.

TABLE 44—*Numbers and Values of Sheep and Swine as of January 1, 1926-1928*

	1926	1927	1928
Sheep (value per head)—			
Lambs	$8 50	$7 50	$8 50
Ewes	11 00	10 50	12 00
Wethers	9 20	8 50	8 20
Rams	23 00	23 00	25 00
All sheep	10 60	10 00	11 30
Total number	3,200,000	3,392,000	3,528,000
Total value	$34,078,000	$33,806,000	$40,014,000
Swine (value per head)—			
All ages	$15 20	$17 00	$13 00
Total number	468,000	585,000	614,000
Total value	$7,114,000	$9,945,000	$7,982,000

TABLE 45—*Estimated Number of Sheep and Swine on Farms, January 1, 1926-1928*

Counties	Sheep			Swine		
	1926	1927	1928	1926	1927	1928
DISTRICT No. 1—						
Del Norte	1,000	1,000	1,000	550	550	550
Humboldt	78,000	85,000	87,000	6,000	6,500	6,500
Mendocino	136,000	136,000	140,000	13,000	14,000	15,000
DISTRICT No. 2—						
Shasta	37,000	38,000	39,000	16,000	16,500	16,500
Siskiyou	12,000	14,000	16,000	11,000	11,500	11,700
Trinity	4,500	4,500	4,500	4,500	4,500	4,500
DISTRICT No. 3—						
Lassen	78,000	80,000	81,000	3,500	3,600	3,600
Modoc	86,000	95,000	97,000	5,000	5,100	5,100
Plumas	1,500	1,500	1,500	1,000	1,000	1,000
DISTRICT No. 4—						
Alameda	24,000	28,000	32,000	9,000	14,400	15,000
Contra Costa	42,000	44,000	45,000	5,500	6,400	6,500
Lake	20,500	21,500	22,000	5,000	5,600	5,600
Marin	7,500	8,500	9,000	10,000	12,200	12,500
Monterey	18,500	22,500	23,000	11,500	18,500	20,000
Napa	28,000	27,000	29,000	12,500	16,500	17,000
San Benito	35,000	35,000	36,000	3,500	4,200	4,200
San Luis Obispo	4,500	5,000	5,000	11,500	15,500	17,000
San Mateo	18,000	18,000	18,000	2,800	3,100	3,200
Santa Clara	1,000	1,000	1,000	4,400	5,100	5,100
Santa Cruz	2,500	2,500	2,500	2,000	2,400	2,400
Sonoma	85,000	90,000	92,000	12,200	14,400	15,000
DISTRICT No. 5—						
Butte	86,000	88,000	95,000	17,000	20,500	22,000
Colusa	188,000	200,000	210,000	19,000	23,500	24,000
Glenn	245,000	255,000	257,000	13,000	16,500	17,000
Sacramento	48,000	54,000	56,000	5,500	7,500	8,500
Solano	170,000	185,000	190,000	5,500	6,500	7,000
Sutter	55,000	60,000	64,000	8,500	10,500	11,500
Tehama	255,000	265,000	275,000	11,500	15,500	17,000
Yolo	172,000	181,000	183,000	29,000	36,000	37,000
Yuba	57,000	60,000	62,000	3,000	3,500	3,600
DISTRICT No. 5A—						
Fresno	190,000	195,000	210,000	13,500	16,500	17,000
Kern	210,000	222,000	230,000	10,000	13,000	15,000
Kings	120,000	132,000	135,000	12,000	15,500	16,000
Madera	45,000	48,000	52,000	6,500	7,500	8,000
Merced	100,000	110,000	120,000	10,000	14,000	15,000
San Joaquin	83,000	90,000	100,000	13,500	17,500	19,000
Stanislaus	43,000	43,000	45,000	9,000	12,500	14,000
Tulare	115,000	120,000	125,000	25,000	32,000	34,000
DISTRICT No. 6—						
Alpine	12,000	12,500	12,500	250	250	250
Amador	17,500	18,500	19,000	4,100	4,500	4,500
Calaveras	34,000	34,000	35,000	3,100	3,500	3,500
El Dorado	18,000	18,500	18,500	1,800	2,100	2,100
Inyo	20,000	20,000	22,000	400	400	400
Mariposa	12,000	15,000	16,000	4,500	4,800	4,800
Mono	20,000	23,000	24,000	300	300	300
Nevada	9,500	10,500	10,500	1,300	1,800	1,800
Placer	40,000	45,000	46,000	2,200	2,800	2,800
Sierra	1,000	1,000	1,000	400	400	400
Tuolumne	5,000	5,000	5,000	2,500	3,000	3,000
DISTRICT No. 8—						
Imperial	62,000	75,000	78,000	20,000	25,000	27,000
Los Angeles	7,000	7,000	7,000	16,500	23,500	25,000
Orange	1,000	1,000	1,000	1,200	1,500	1,600
Riverside	20,000	20,000	21,000	5,600	6,500	6,600
San Bernardino	2,000	2,000	2,000	20,000	28,000	29,000
San Diego	3,000	3,500	4,000	11,000	14,000	14,500
Santa Barbara	7,000	7,500	8,000	7,300	8,400	8,500
Ventura	6,500	7,000	7,000	3,600	4,200	4,400
State	3,200,000	3,392,000	3,528,000	468,000	585,000	614,000

TABLE 46—*January 1 Farm Values of California Live Stock per Head, 1869-1928**

Year	Horses, dollars	Mules, dollars	Milk cows, dollars	Other cattle, dollars	Sheep, dollars	Hogs, dollars
1869	$52.71	$73.92	$50.31	$27.86	$2.53	$5.52
1870	36.50	66.66	47.62	26.22	2.56	4.47
1871	50.26	65.64	46.36	26.92	2.59	5.94
1872	43.59	59.76	44.66	23.80	2.78	5.05
1873	44.15	71.06	43.44	22.71	2.97	6.11
1874	47.48	63.74	35.28	19.52	2.31	6.16
1875	41.61	66.49	32.19	18.92	2.53	5.77
1876	45.46	77.20	31.46	20.08	2.02	7.17
1877	39.50	67.75	30.64	16.52	1.40	6.20
1878	40.94	68.98	28.23	17.23	1.52	6.27
1879	43.95	66.24	25.90	18.91	1.61	5.95
1880	46.18	67.54	28.65	18.47	1.62	3.97
1881	45.03	68.79	31.67	20.35	1.70	4.98
1882	47.30	69.20	32.70	21.77	1.65	6.20
1883	54.89	70.98	36.17	27.48	2.02	7.14
1884	61.33	80.18	38.00	29.15	1.90	5.66
1885	62.05	84.30	38.50	30.38	1.89	5.80
1886	63.00	77.65	38.75	28.66	1.81	4.15
1887	64.00	83.67	33.22	20.64	1.77	3.78
1888	71.00	85.03	33.00	20.50	1.88	4.62
1889	70.19	83.78	31.38	19.37	1.88	5.59
1890	63.60	78.21	27.75	16.80	2.08	4.91
1891	67.22	79.41	29.00	17.73	2.20	5.26
1892	62.67	74.72	26.95	17.39	2.42	5.35
1893	57.48	67.90	27.25	17.12	2.32	6.12
1894	41.98	56.38	25.82	16.17	1.81	5.57
1895	31.94	46.25	23.78	15.28	1.65	5.54
1896	27.16	35.02	23.75	15.82	1.85	4.03
1897	27.40	36.89	25.57	16.93	1.86	4.13
1898	28.96	38.33	28.65	18.91	2.23	4.08
1899	27.54	34.15	28.00	18.01	2.64	4.47
1900	38.61	48.49	33.75	24.57	2.85	6.26
1901	49.66	60.44	37.10	22.25	3.00	6.61
1902	56.28	69.23	40.05	23.48	2.90	6.79
1903	60.66	72.02	40.43	24.51	2.92	7.63
1904	65.66	72.68	38.55	21.98	2.75	6.55
1905	67.48	76.39	36.57	19.29	2.67	6.10
1906	76.32	91.30	34.65	17.52	3.03	5.45
1907	92.00	106.00	35.00	18.00	3.30	7.10
1908	94.00	113.00	36.00	19.00	3.47	7.20
1909	90.00	107.00	36.00	17.50	2.80	6.50
1910	105.00	122.00	38.40	20.10	3.30	8.20
1911	117.00	133.00	48.00	23.50	3.59	9.50
1912	117.00	136.00	53.00	26.70	3.60	8.30
1913	109.00	130.00	53.50	29.20	3.70	9.20
1914	100.00	120.00	62.00	33.00	3.80	10.50
1915	100.00	120.00	72.00	39.30	4.50	10.50
1916	96.00	110.00	69.00	36.30	5.00	8.40
1917	97.00	116.00	67.00	38.10	6.70	10.10
1918	98.00	115.00	72.50	42.10	11.30	17.50
1919	91.00	125.00	79.00	48.20	12.00	18.00
1920	98.00	120.00	97.00	51.90	10.90	18.00
1921	98.00	123.00	95.00	44.50	6.70	14.50
1922	84.00	103.00	76.00	34.30	5.30	11.70
1923	83.00	105.00	76.00	34.30	8.10	11.80
1924	85.00	106.00	76.00	33.30	9.00	10.50
1925	78.00	95.00	73.00	30.00	9.20	10.20
1926	76.00	92.00	77.00	34.10	10.60	15.20
1927	76.00	89.00	78.00	37.00	10.00	17.00
1928	73.00	83.00	83.00	43.00	11.30	13.00

*Source of data United States Department of Agriculture, Statistical Bulletin No. 17

TABLE 47—*Estimated Number, Value per Head and Total Value of the Different Classes of Live Stock on Farms in California and the United States on January 1, 1920-1928*

Item and year	California			United States		
	Number (000 omitted)	Value per head	Total value (000 omitted)	Number (000 omitted)	Value per head	Total value (000 omitted)
Horses and colts—1920	402	$98 00	$39,396	19,848	$96 52	$1,915,729
1921	375	98 00	36,750	19,134	84 57	1,618,162
1922	360	84 00	30,240	18,564	71 18	1,321,386
1923	335	83 00	27,805	17,943	70 65	1,267,673
1924	335	85 00	28,475	17,222	65 48	1,127,697
1925	314	78 00	24,448	16,489	64 26	1,059,553
1926	302	76 00	22,938	15,830	65 50	1,036,843
1927	295	76 00	22,313	15,145	64 13	971,258
1928	290	73 00	21,302	14,541	67 07	975,298
Mules and mule colts—1920	63	120 00	7,560	5,475	148 46	812,819
1921	60	123 00	7,380	5,586	117 52	656,467
1922	61	103 00	6,283	5,638	89 14	502,571
1923	62	105 00	6,510	5,702	87 17	497,043
1924	59	106 00	6,254	5,730	85 90	492,207
1925	56	95 00	5,315	5,725	82 73	473,646
1926	54	92 00	4,964	5,740	81 49	467,760
1927	53	89 00	4,723	5,679	74 49	423,010
1928	53	83 00	4,420	5,566	79 60	443,097
Milk cows—2 years old and over—1920	515	97 00	49,955	21,427	85 56	1,833,294
1921	530	95 00	50,350	21,408	64 13	1,372,895
1922	550	76 00	41,800	21,788	50 97	1,110,534
1923	580	76 00	44,080	22,063	50 94	1,123,889
1924	595	76 00	45,220	22,255	52 30	1,163,937
1925	579	73 00	42,267	22,481	50 67	1,139,159
1926	596	77 00	45,892	22,188	57 34	1,272,328
1927	596	78 00	46,488	21,818	62 43	1,362,006
1928	602	83 00	49,966	21,948	77 43	1,699,526
All other cattle—1920	1,493	51 90	77,553	47,444	42 19	2,001,443
1921	1,470	44 50	65,450	45,776	30 59	1,400,461
1922	1,498	34 30	51,384	45,476	23 15	1,052,676
1923	1,500	34 40	51,600	44,093	24 80	1,093,660
1924	1,547	33 35	51,598	42,252	24 44	1,032,526
1925	1,340	30 55	40,932	39,515	23 94	946,065
1926	1,322	35 16	46,480	36,934	27 50	1,015,601
1927	1,360	37 00	50,316	35,054	29 87	1,047,071
1928	1,393	42 80	59,617	33,748	38 95	1,314,560
Sheep and lambs—1920	2,900	10 90	31,610	40,243	10 46	420,942
1921	2,750	6 70	18,425	38,690	6 28	242,973
1922	2,475	5 30	13,118	36,186	4 80	173,693
1923	2,600	8 10	21,060	36,212	7 53	272,676
1924	2,890	9 00	26,010	36,876	7 91	291,689
1925	3,045	9 20	28,140	38,112	9 70	369,612
1926	3,200	10 60	34,078	39,730	10 51	417,630
1927	3,392	10 00	33,806	41,846	9 71	406,231
1928	3,528	11 30	40,014	44,545	10 22	455,224
Swine—including pigs—1920	909	18 00	16,362	59,813	19 08	1,141,232
1921	818	14 50	11,861	58,711	12 98	762,069
1922	818	11 70	9,571	59,355	10 06	597,111
1923	818	11 80	9,652	68,447	11 58	792,616
1923	624	10 50	6,552	65,937	9 72	640,908
1925	532	10 20	5,426	55,568	12 38	687,858
1926	468	15 20	7,114	52,148	15 21	793,139
1927	585	17 00	9,945	54,408	15 97	868,842
1928	614	13 00	7,982	58,969	12 03	709,217

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NINTH REPORT

OF THE

California

Department of Agriculture

FOR THE

PERIOD ENDING DECEMBER 31, 1928

SACRAMENTO, CALIFORNIA

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THE MONTHLY BULLETIN

DEPARTMENT OF AGRICULTURE

STATE OF CALIFORNIA

DEVOTED TO AGRICULTURE IN ITS BROADEST SENSE, WITH SPECIAL REFERENCE TO THE REGULATORY AND SERVICE ACTIVITIES OF THE DEPARTMENT OF AGRICULTURE.

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FOREWORD

OF ALL the large producing states, California, although not entirely unscathed, doubtless has suffered less from the depression of the past few years, and if we can except a few of our many important crops, on the whole this state had little cause for complaint of conditions in 1928. There are many factors responsible for this, not the least of which is the diversity of our agricultural production.

The total tonnage of all main field, fruit and vegetable crops produced in California in 1928 exceeded that of any previous year and it is estimated that the total value in 1928 was slightly in excess of 1927, although the unit value of most of these crops was less. Aside from cling peaches, which showed a heavy overproduction, prices of fruits were fair and prunes brought the best price received for several seasons.

The dairy, beef cattle and sheep industries, as in 1927, continued to enjoy relatively favorable conditions in California as they did elsewhere throughout the country. Increase in production of dairy products, however, was comparatively small in this state, hardly more than enough to keep pace with increased population, although a large portion of our supply of butter and cheese continued to flow in from other states.

During the year several new projects were put into operation in the department. A short wave broadcasting system was perfected for the transmission of agricultural news. Permanent stations were set

up in Sacramento, San Francisco and Los Angeles, and field stations made available for all important fruit and vegetable shipping centers. Through the cooperation of the short wave stations information as to condition of crops, markets and movements of commodities has been made available to farmers and shippers in a more expeditious manner and at less expense than was possible heretofore. It is believed that this will make it possible for market organizations to function more efficiently and thus reduce the element of chance in the marketing of farm products.

Few outstanding problems occurred in the state along plant pest lines. Citrus white fly control has reduced this pest to an economic minimum and plant diseases showed no disposition to exceed the normal for other seasons.

There were no serious outbreaks of infectious diseases of animals throughout the year and efforts have been directed towards the control and eradication of those indigenous diseases long existent here and the careful supervision of imported animals.

Although California has been a pioneer among the states in bovine tuberculosis control, absence of adequate laws and funds has retarded the progress of this important economic and public health function. Careful study is being made of this subject, however, with the hope that the live stock and dairy industries may unite on some comprehensive tuberculosis control plan to be offered for adoption by the incoming legislature.

The detailed reports of the divisions and bureaus of the department appended herewith will give some idea of the scope of departmental activities for the 1928 calendar year.

G. H. Hecke.

THE MONTHLY BULLETIN

BUREAU OF FRUIT AND VEGETABLE STANDARDIZATION

W. F. ALLEWELT, Chief

THE BUREAU of Fruit and Vegetable Standardization carried on five functions during 1928, as in former years, as follows:

1. Fruit and Vegetable Standardization Service.
2. Apple Standardization Service.
3. Canned Fruit Standardization Service.
4. Fruit and Vegetable Certification Service (Shipping Point Inspection).
5. Potato Seed Certification Service.

The California Fruit, Nut and Vegetable Standardization Act of 1927, effective during the previous year, operated very satisfactorily throughout 1928. The provisions in general proved to be clear, definite and enforceable, and acceptable to growers, packers and shippers on the one hand, as well as to market dealers and consumers on the other.

Some points, however, developed which made it advisable to strengthen some of the provisions, particularly with regard to mislabeling, and the control of products transported to an increasing extent by motor truck. Also those interested in some of the commodities, such as grapefruit, pears and lettuce, expressed a desire for further tightening the requirements affecting these products, to insure more satisfactory deliveries to the trade and consumers.

Consequently the bureau, together with county horticultural commissioners, took up these questions with those interested. A number of the commodity subcommittees, organized in connection with the State Committee on Fruit and Vegetable Standardization by the California Agricultural Legislative Committee in 1926, met to consider changes in the legislation. This work was well under way before the end of the year, in advance of the meeting of the legislature in 1929.

Changes also were recommended by the bureau in the California Standard Apple Act, in order to consolidate the provisions of this act with the general standardization law, and in the California Canned Fruit Standardization Act. These problems were discussed in detail with the representatives of the affected industries, in order to agree upon a common program.

At the request of the California Farm Bureau Federation, representatives of this bureau met with their board of directors at different times to discuss the canned fruit standardization, and proposals of the Farm Bureau for official state grades and inspection for green fruit delivered to the canneries, and for dried fruit.

It was explained that sufficient legal authority now exists to set up optional official grades for these products, and that it doubtless would be possible to secure the cooperation of the United States Department of Agriculture in this work so that such standards, if desired, might be promulgated as United States grades or national standards. It also was pointed out that authority now exists for the optional inspection of such products, at the request of the grower or other financially interested parties, and for the issuing of certificates receivable as prima

facie evidence in California courts and all federal courts in the United States. However, since the department previously has had little call for service in connection with dried fruit grading and inspection, no one experienced in this work has been employed, and in fact we have had no financial provision for carrying on this work.

In order to secure definite first hand information on the quality and condition of our fresh fruits and vegetables on arrival in the eastern markets, and the attitude of the trade there toward our standardization program, with suggestions for its improvement, Mr. S. S. Rogers, assistant chief of the bureau, spent a number of weeks in several of the large cities of the east during the arrival of our deciduous tree fruit, grape, citrus fruit and vegetable crops. Through his wire reports in a number of instances we were able to check quickly and effectively on situations which were causing some difficulties, and upon his return a series of meetings were held where his observations were placed before growers and shippers, for their information and assistance. A report on the results of this trip also was prepared for publication in the MONTHLY BULLETIN of the department. On all sides the reaction of the industry to this work was most favorable, and many requests and recommendations have been received for a continuation and expansion of this line of activity.

Another feature of the work in which increasing interest has been manifested is the certification of fruits and vegetables shipped by water from the ports of San Francisco and Los Angeles to the Orient, Central and South America, and Europe. Greatly increased refrigeration facilities of the steamship lines are leading to a considerable expansion in this business. Problems of suitable standards and certification of products moved in this trade have been discussed with growers, packers, and exporters, in order to develop a service of the greatest possible value to those engaged in this business.

Use of the "Export Form Certificates" has been continued, in connection with the requirements of some foreign countries relative to spray residue on apples and pears, and no reports have been received of any difficulties experienced by such shipments at their destination.

FRUIT, NUT AND VEGETABLE STANDARDIZATION, 1928*

Since the provisions of the new California Fruit, Nut and Vegetable Standardization Act of 1927 became effective on August 1 of that year, they have been applied from that time on the products which have been harvested, packed, shipped or sold. During 1928, however, these requirements applied for the first time to those crops which are moved before August 1. As in 1927, meetings between the county horticultural commissioners and their inspectors, with representatives of the department, were continued during the present year for the purpose of discussion and clarification of provisions of the new law. In addition to this, many meetings of growers and packers were held by a number of the county horticultural commissioners in conjunction with the department for the purpose of thoroughly acquainting growers, packers and shippers with the requirements now in effect on the various commodities. Generally speaking, little difficulty was experienced in the administration of this law, as the growers and

* By H. W. Poulsen, Supervising Inspector in Charge.

shippers have become accustomed to the new provisions. Practically all of those engaged in the industry now are in favor of this act. In fact, practically all recommendations for change which have been made are for the purpose of further strengthening its provisions.

During 1928, considerably more than 250,000 carloads of fruits and vegetables, most of which were shipped out of the state, were governed by specific provisions of the act, in addition to the requirements governing misbranding and deceptive pack which apply to all fresh and dried fruits, nuts and vegetables. The inspection of carloads of produce, most of which are handled at central packing houses and shipping stations, does not afford any particular difficulty. On the other hand, a large increasing volume of fruits, nuts and vegetables moved from the producing districts to the markets of California by trucks. The inspection of produce so transported is extremely difficult because the products can be loaded at the ranches and generally moved



FIG. 116.—One of the highway inspection stations located near Tracy, where all trucks carrying fruits and vegetables are stopped for inspection to insure of correct grade marks. Large numbers of produce pass through these stations especially at night, which is the busiest time for the horticultural inspectors in charge.

by a number of different roads from the county of origin. In this way there is no central point at which it is possible for the horticultural inspectors to examine such shipments for compliance with the law. However, one of the outstanding accomplishments during the year in the administration of this law was the more effective enforcement of its provisions in regulating this large amount of produce carried to our state markets by means of trucks.

Until recent years emphasis has been placed by the industry on the inspection of carload shipments, but the growers and shippers now are realizing that California affords the most important market in the world for her own products, and that the inspection of local shipments is equally important as inspection of those shipped out of the state. In order to more adequately provide for the inspection of increased movement, additional highway inspection stations have been established

during 1928. These were conducted principally by the county horticultural commissioners of adjoining counties, assisted by representatives of the department, including additional men employed for this purpose.

At Lebec on the Ridge Route highway, the horticultural commissioners of Kern and Los Angeles counties, as in former years, maintained a joint inspection station during the grape shipping season. Since the numerous truck loads which were rejected at this station could not well be reconditioned at that point, the state department cooperated with the horticultural commissioner of Los Angeles County in maintaining 24-hour service in the Los Angeles market for the purpose of insuring proper reconditioning of all rejected loads upon arrival at that point. The average movement of fruits and vegetables through this station for the period during which it was maintained was approximately eight carloads per day, reaching as high as fifteen carloads during a twenty-four hour period. It was very noticeable that within a short time from the opening of this station most of the trucks passing this point carried clearance certificates issued by the horticultural inspectors at points of origin in Kern and Tulare counties.

As a result of occasional inspections made during 1927 and preceding seasons, a new station was maintained by Stanislaus and San Joaquin counties in cooperation with the State Department of Agriculture, located on the main highway leading from the San Joaquin Valley to the San Francisco Bay markets. This station was operated during the heavy shipping season for a period of from twelve to fifteen hours per day during the time of the heavy movement. The average daily movement of fruits and vegetables passing this station was from ten to twelve carloads, reaching as high as seventeen within a single day. Very noticeable results were observed in the markets receiving this produce immediately after the establishment of these stations, and numerous expressions of appreciation from producers, as well as the dealers in the markets, have been received. In addition to these stations, several others were maintained by county horticultural commissioners, in cooperation with the department, particular mention being made in the report on apple standardization of the effective work carried on in Santa Cruz and Sonoma counties, which is mainly for the purpose of apple inspection.

Additional attention also has been given to the inspection of fruits and vegetables offered for sale in the markets of the state. Field representatives of the department have cooperated with the horticultural commissioners and their inspectors in the inspections made in these markets. In some of the markets, particularly the very important marketing area of Los Angeles County, the situation has been materially improved through employment of additional men by the horticultural commissioners, but in other large markets of the state a serious need still exists for more adequate coverage than we have at the present time.

One of the most important activities, requiring considerable attention from this department, was the enforcement of the law as applied to the movement of California's immense grape crop. Although the enforcement conducted by the county horticultural commissioners, in cooperation with the department, was more uniform and efficient than in previous years, large supplies of inferior stock, especially in the case of white varieties, were sent to the markets. This condition largely was

due to the presence of weak stems and berries, and to poor color and size, especially in the case of the Thompson Seedless, Malaga and Muscat varieties. Although these grapes were mature and free from defects within the requirements of the act, this extensive inferior condition, over which the law affords no control, was extremely detrimental to the marketing of this crop. Realizing this condition the Department of Agriculture and county horticultural commissioners did everything possible to persuade growers and packers to maintain a standard much higher than that required by the law.

In the case of Tokay grapes the color adjustment, which was made in the case of the fancy and No. 1-A grades, worked out in a very satisfactory manner. With the exception of a few cases in the early producing sections, the enforcement work, in connection with this variety, was very satisfactorily handled.

Another important product which required much attention from the department, as well as the horticultural commissioners, was oranges. The Valencia crop, which was harvested during the spring and summer months, escaped any serious damage from freezing during the previous winter, in some cases due to the use of more adequate heating equipment than had been available during previous seasons. It was necessary, however, to keep a close watch on the shipments from the San Joaquin Valley, where some damage was experienced. In the case of lemons some damage from freezing was found, and considerable trouble was experienced in policing shipments from Fresno and Tulare counties, where many loads were trucked directly from the orchards to receiving markets. Many lots of lemons also were rejected because of drying at the blossom and stem ends.

With very high prices prevailing during the last part of the Valencia shipping season, all growers and shippers of early Navels were anxious to start harvesting and moving their crops as soon as possible. Although serious difficulty was experienced in the enforcement of the maturity provisions in certain localities, this work in most sections of the state was conducted more satisfactorily than has been the case in previous seasons. Some difficulty also was encountered in preventing packers and dealers from accelerating the color of oranges which failed to test eight parts of soluble solids to one of acid.

Since practically all of the strawberry crop in 1927 had been harvested before the new act became effective, the 1928 crop was the first to be regulated by the provisions of the present law, which specifically states that face packed berries shall not exceed a variation of one-fourth of an inch in diameter within any container. Numerous meetings of growers were held in order to fully explain these requirements. As a result of these meetings, and the rigid inspection and successful prosecutions in the case of subsequent violations, great progress was made during the season in the elimination of deceptive packs. In practically all districts, excepting some of the coast counties, berries very generally were placed loose in the containers, thereby largely eliminating the tendency toward deception in packing. Some progress was made in the coast section, where face packs have been prevalent, in eliminating the large chests which have been used for a number of years, replacing them with crates, which are far better adapted to the loose pack.

Deciduous fruits, while generally very ordinary in quality, in most cases were packed and shipped in full compliance with the law. The crop in some districts was damaged by hail, and in the case of apricots, peaches, plums and pears it was the desire and practice of most of the packers to hold shipments well above the requirements of the law in respect to hail damage. In fact, numerous recommendations were made to the department that the law be strengthened in this respect at the coming session of the legislature. As usual, shot hole fungus was a troublesome defect in the case of apricots, and inspectors found it



FIG. 116. A deceptive pack of strawberries, which is prohibited by the California Fruit, Nut and Vegetable Standardization Act. Note the difference in size between the faced berries and those in the baskets from which the top layer has been removed.

necessary to reject many lots of fruit on this account. Growers of Red Bird cling peaches in southern California lost a considerable part of their crop on account of a very large percentage of open split pits, and as a result have asked for amendment of the law to afford them relief on this point. However, other growers and packers of peaches in the state, in discussing this situation, invariably have expressed the opinion that open split pits are a serious defect, and that no modification of this requirement should be made.

As has been the case in previous seasons a considerable quantity of Bartlett pears was harvested and shipped before they had attained a really desirable maturity or size. While this early movement is occasioned by the desire for high prices for the first shipments, it unquestionably depresses the demand and price for the heavy volume of later shipments which are far more satisfactory in quality. Growers and shippers now have very generally agreed that it is necessary to adopt the recommendation of this department, made several years ago, to incorporate in the standardization act specific maturity provisions governing Bartlett pears, so that enforcement officials can prevent the packing and shipping of immature and undeveloped fruit.

With the exception of occasional lots of windfall or stolen fruit, little difficulty was experienced in the enforcement of the law relative to avocados. Several shipments of this fruit from Florida, however, were rejected because of an oil content below the requirements of the California law. This department, in cooperation with Florida officials and growers, has continued a study of the oil content of West Indian varieties produced in that state. During November, a meeting of the avocado standardization committee was held with Florida officials, when this subject was discussed and arrangements made for a further study of the situation with the purpose of determining specifically whether the requirements of the California law, with regard to this class of fruit, need to be modified.

Numerous lots of artichokes were rejected on account of severe freezing damage and worm injury, and the strict enforcement in producing sections has produced noticeable results in increased returns to the growers.

Much difficulty was experienced in the packing and shipment of cantaloupes, largely on account of lack of proper development and maturity, or because of an overripe and sunburned condition. Some trouble also was experienced on account of immaturity and deceptive loading of watermelons.

Originating in Santa Barbara County there has been a strong demand from growers and shippers of cauliflower and broccoli for inclusion of this product under specific requirements of the law. As a result of meetings held by the department in all of the important producing sections of the state, steps have been taken to present such requirements in the form of an additional section of the act to the 1929 legislature. This action has the unanimous approval of growers and packers from all districts. During 1928 the usual difficulty was experienced in connection with mismarking of counts on both cauliflower and celery. It also was necessary to correct deceptive packing practices in the handling of fresh peas, beans and early potatoes in various districts.

Considerable attention was paid to the proper marking of dates, particularly imported stock, to show the point of origin as required by law. A great deal of attention also was paid to the inspection of walnuts in order to insure that nuts packed, shipped or offered for sale met the requirements of the law, both with respect to quality and proper markings.

The enforcement of the law as applied to other products presented no unusual problems, and was conducted with apparent satisfaction to all parties concerned. The industry is in full accord with the purpose

of the standardization laws and with their proper enforcement. This is proved by the fact that practically all requests which have been received by the department for modification of these laws have been in favor of further strengthening their provisions.

APPLE STANDARDIZATION, 1928*

An abundant crop of apples was produced in 1928 in practically every producing section of California, the Watsonville and Sebastopol sections supplying about 70 per cent of the total. Yucaipa, Beaumont and other mountain and foothill districts, together with a few scattering valley sections, furnished the remainder. The actual production of fruit of commercial quality was considerably in excess of the amount which was so used. The price of dried apples remained uniformly favorable and this fact, together with the low prices offered for fresh apples, turned a large volume, particularly from the Watsonville district, to the evaporators.

During the early part of the growing season indications were that the 1928 crop would be early. However, periods of unfavorable weather delayed proper development of the fruit and shipments finally started on about the usual average dates in both large commercial districts. At Sebastopol an early spell of hot weather when the fruit was half developed arrested size, development and maturity. Cold days and nights delayed the crop at Watsonville, and excessively hot days when the apples were fully developed caused considerable severe sun scald on exposed fruit, and impaired the keeping quality of apples which were over-heated, although not scalded.

The committees appointed at the request of the department in 1927 by the organizations of apple growers and packers at Sebastopol and Watsonville were continued in effect, and materially assisted the enforcing officials in the determination of satisfactory maturity, and in deciding cases where this factor was in question.

Proper maturity of the fruit continues to be a problem of primary importance. As in the past the department, together with the committees, used all available information concerning maturity of the fruit in deciding upon the stage of development at which the first fruit could be considered as mature, and packed under the classified grades. However, there still seems to be something wrong with the system followed, since reports have indicated that much of the first packing, as formerly has been the case, turned out to be poor or very ordinary in quality by the time the apples reached the receiving markets. While this fact has become generally recognized by the growers, who showed a friendly attitude toward the efforts of the department in upholding maturity standards, there always is an effort on the part of some individuals to rush out early shipments, even if these have to be marked unclassified on account of lack of proper maturity. This, of course, is most acute in the Sebastopol section, which is one of the earliest districts in the United States. While favorable prices sometimes are received for a few of the earliest shipments, the observations of a representative of the department in the eastern markets this year showed that buyers are not willing to purchase any appreciable quantity of the early immature fruit, which almost invariably arrives with a large percentage of bitter

* By C. H. Beasley, Supervising Inspector in Charge.

pit, preferring to wait a week or ten days, when arrivals show far better quality and condition. This results in the clogging up of the channels of distribution with the early immature fruit, and without doubt greatly depresses the prices received for the larger volume of apples of superior quality and grade arriving during the height of the season. Experience has shown very conclusively that it is highly important that both Gravensteins and Bellefleurs be past the first stage of maturity when picked. If this plan were followed the subsequent developments of Baldwin Spot or bitter pit would be decreased materially, and these varieties would reach the markets and hold up in much better condition. This fact alone should be sufficient to cause growers and shippers to wait for an additional week or ten days beyond the period of maturity at which picking generally is begun.

In the case of the Newtown Pippin, the other important commercial variety produced in California, maturity lines do not have to be drawn

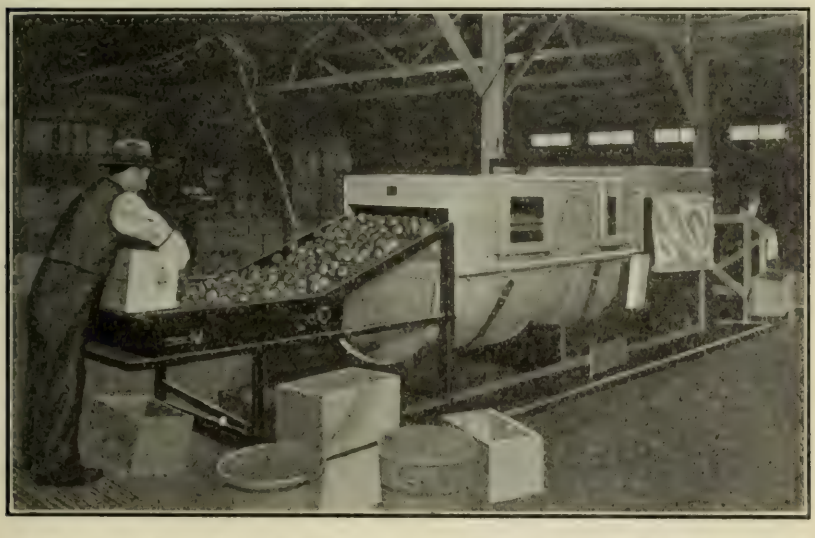


FIG. 117. Washing apples in the Watsonville district. This is a new practice in California apple sections and many such machines are expected to be in operation next season. Excellent results have been obtained, the first car washed bringing about $10 per ton more than unwashed apples of the same quality being sold on the same day. The capacity of this machine is 1200 boxes per day. It costs about 2½ cents per box to operate this machine.

so closely. As a rule Baldwin Spot is not a serious disease in this variety. Internal Browning is to be most feared, and the development of this condition is most common in apples which are fully ripe at the time of harvesting.

It seems a difficult matter to extend the Gravenstein season over a period of more than six weeks. A quick beginning and abrupt ending usually mark each year's shipments of that variety, making it necessary for the department to have the inspection force selected, trained and ready when the season begins. With an experienced man in charge of the northern district, located at Sebastopol, daily contact with the

inspectors in all parts of the district was maintained, and the growers and shippers were rendered every possible service. About fifteen apple inspectors were required in both the Sebastopol and Watsonville districts. Shipments in the Gravenstein district began about July 1 and lasted until Watsonville apples started to move, the latter district harvesting fruit from about August 15 to November 1. After that date, shippers begin to draw from common and cold storage stocks to continue their movement through the following June.

In the apple work the inspectors of the department have two separate duties; first, the enforcement of legal standardization requirements, and second, the writing of federal-state shipping point certificates on carlots examined. These two functions are entirely separate in handling the standardization and certification work on all other commodities, and this department again reiterates its repeated recommendations that an apple section should be incorporated in the California

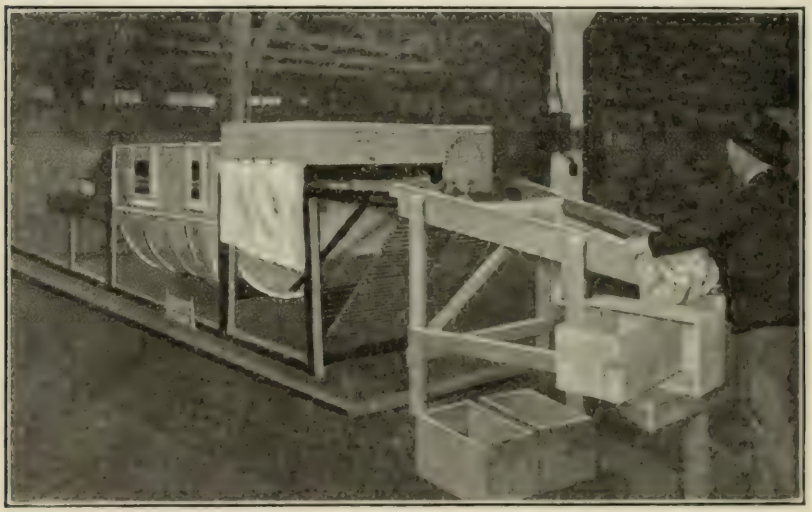


FIG. 118. Apple washing machine, installed for Rogers Bros. at Corralitos Fruit Growers' plant at Watsonville. A 2 per cent caustic soda solution is used and the fruit is thoroughly dried by air blasts after treatment.

Fruit, Nut and Vegetable Standardization Act, so far as legal requirements are concerned, and that the certification of this product be handled on request in the same manner as is now done in the case of all other fruit and vegetable commodities.

In the principal commercial producing districts at Watsonville and Sebastopol it is possible for the department, with valuable assistance from the horticultural commissioners of Santa Cruz and Sonoma counties, to adequately inspect not only all of the apples moved in carlots, but also the heavy volume which goes out by motor truck. In other districts, however, such as Yucaipa-Beaumont, which move their crops entirely by means of motor trucks, the inspection work is done almost exclusively by county horticultural commissioners and their inspectors, under the general direction of the State Department of Agriculture.

While practically all of the large transportation companies cooperate fully with the inspection work, most of the substandard fruit found on the markets of the state has been delivered by means of trucks which are individually owned and operated. The possibility of evasion of inspection is obvious, and the standardization problems on apples, as well as on other commodities, could be greatly minimized if an effective system of inspection on arterial highways could be organized. This, however, would involve a considerable appropriation on the part of the state, in addition to expenditures by the county boards of supervisors, to provide for effective cooperation by the horticultural commissioners of counties which are principally interested.

In addition to the regular apple standardization inspectors of the State Department of Agriculture, this department has four men in the field working in cooperation with the county horticultural commissioners to enforce the legal requirements in connection with apples, as well as other commodities, in the receiving and distributing markets of the state. A considerable amount of the apple work handled by these men consists of the inspection and supervision of shipments arriving from other states. During the present season, as in some former years, considerable difficulty has been experienced in connection with grossly deceptive packs of basket apples received from Idaho. This has been called to the attention of the authorities in that state and it is expected that the situation will be corrected. Such packs, when found, are required to be properly reconditioned before the fruit can be offered for sale.

The department again recommends serious consideration of improvement of the specifications of the apple grades established in the California Standard Apple Act. It is felt that these should be materially strengthened, particularly in the case of the fancy grade. The disadvantages in the use of the irregular Watsonville apple box, with square pack and tier markings, appears so obvious that it should be unnecessary to repeat our continued recommendations against its use. However, this container and system of packing and marking still are used to a considerable extent in the Watsonville district. Exporters and receivers of this fruit continually register objections to such deliveries. Out of a total of 3058 carlot shipments from the Watsonville district in 1928, 2964 cars were covered by certificate. Certificates also were issued on 1900 cars from a total movement of 1918 cars from the Sebastopol district. These shipments were made between July 1, 1928, and December 15 of the same year, with about 1000 cars in Watsonville storage still to be shipped. Between January 1, 1928, and June 30, of the same year, 554 cars of storage apples were moved from Watsonville, covered by certificate. Practically all other districts of the state move their crop by truck, with the exception of a few cars from Sutter, Butte and Tuolumne counties. On December 15, 1928, records indicate that approximately two and a half million boxes of apples were held in cold storage in California, principally at Watsonville, Los Angeles, San Francisco, Oakland, San Jose and San Diego.

The total output of boxed apples from the Watsonville district for the 1928 season consisted of 854,930 packed boxes of fancy, and 28,500 loose boxes of fancy grade, together with 147,982 boxes of packed

unclassified apples and 1,589,892 boxes of loose unclassified apples. The following table shows the distribution of these apples by varieties:

WATSONVILLE DISTRICT, SEASON OF 1928

Packed

Variety	*Fancy*	*Unclassified*	*Total*
Newtown Pippins	766,500	104,010	870,510
Bellefleurs	30,295	21,444	51,739
W. W. Pearmains	37,744	13,827	51,571
Red Pearmains	1,794	617	2,411
Gravensteins	207	----	207
Miscellaneous	18,390	8,084	26,474
	854,930	147,982	1,002,912

Loose

Variety	*Fancy*	*Unclassified*	*Total*
Newtown Pippins	19,091	445,320	464,411
Bellefleurs	4,438	997,495	1,001,933
W. W. Pearmains	555	20,737	21,292
Red Pearmains	150	14,120	14,270
Gravensteins	2,676	6,041	8,717
Miscellaneous	1,620	106,179	107,799
	28,500	1,589,892	1,618,422
Total packed and loose			2,621,334

Total boxes of loose apples in local cold storage, not included in the above figures, include 780,012 Newtown, 61,627 Bellefleurs and 26,385 miscellaneous varieties, to be sorted on removal from storage. Apples in the district in common storage, and otherwise not accounted for, probably total 300,000 boxes. These figures show for the district about 35 per cent packed apples and 65 per cent loose, the proportion of packed fruit being somewhat larger than ordinary for this district.

In the Sebastopol district, following light shipments beginning July 3, the movement first exceeded five cars per day on July 10, when 20 cars were moved out. The volume rapidly increased, reaching as high as ninety-two cars on July 21, after which it declined until August 18, when the movement again was light with not more than six cars moving in any one day.

The following table shows the proportion of loose and packed apples of the various grades. The preponderance of packed Gravensteins of the fancy grade is apparent. Ninety per cent of the apples from this district were packed with 10 per cent loose.

SEBASTOPOL DISTRICT, SEASON OF 1928

Packed

Variety	*Fancy*	*"C" Grade*	*Unclassified*	*Total*
Gravensteins	1,334,620	6,707	21,384	1,362,711
Miscellaneous	32,356	850	700	33,906
Totals	1,366,976	7,557	22,084	1,396,617

Loose

Variety	*Fancy*	*"C" Grade*	*Unclassified*	*Total*
Gravensteins	12,919	29,753	41,982	84,654
Miscellaneous	1,314	524	10,801	12,639
Totals	14,233	30,277	52,783	97,293
Total packed and loose				1,493,910

The following table of truck inspections in the Watsonville and Sebastopol districts is very significant, showing the large volume of fruit handled in this manner. If this did not receive adequate inspection, nearly all of the benefits of the system of state standardization of this fruit would be lost.

TRUCK SHIPMENTS 1928

	Watsonville district		*Sebastopol district*	
	Trucks Inspected	*Boxes*	*Trucks Inspected*	*Boxes*
January	223	21,187	---	---
February	161	18,075	---	---
March	197	22,073	---	---
April	145	13,570	---	---
May	88	7,076	---	---
June	67	4,584	---	---
July	15	1,067	131	13,458
August	169	20,775	266	26,500
September	572	102,282	105	15,659
October	361	93,992	55	5,490
November	833	128,834	20	3,050
December 15th	174	82,351	---	---
Totals	3,005	515,866	577	64,157

The following table is of interest in showing estimated commercial production, together with the additional quantity used for by-products, in each of the three larger districts during the past three years.

COMMERCIAL AND BY-PRODUCTS SUPPLIES OF APPLES IN PRINCIPAL CALIFORNIA DISTRICTS 1926 TO 1928, INCLUSIVE

(All figures in tons)

	1926	*1927*	*1928*
Watsonville—			
Commercial	56,000	52,000	60,000
By-product	45,000	32,500	56,000
Sebastopol—			
Commercial	28,000	18,000	30,000
By-product	3,000(?)	15,000	26,000
Yucaipa-Beaumont—			
Commercial	6,000	6,100	10,000
By-product	2,500	5,000	2,000

SEED POTATO CERTIFICATION, 1928*

The acreage of potatoes under inspection for certification during 1928 showed an increase of 33⅓ per cent over the previous season, or a total of 136 acres. The following table gives the acreage by varieties entered for certification and that which passed final inspection.

	British Queen	*Netted Gem*	*Bliss Triumph*	*Burbank*	*White Rose*	*Beauty of Hebron*	*Total*
Acreage under inspection	103	23½	2	3	4½	1	136
Acreage passed final inspection	78	3½	2	3	½	1	87
Pounds certified	375,260	52,000	35,000	31,100	4,100	12,500	509,960

* By J. E. Currey, Seed Potato Specialist in Charge.

The variety being certified to date is largely the British Queen. The demand for seed comes from winter potato growers in San Diego and other southern counties. Sufficient certified seed is being grown to take care of the demand and good stocks are available to readily take care of any increase.

As to the White Rose or Pride of Wisconsin variety, to which approximately two-thirds of the potato acreage of the state is planted, the situation is exactly the reverse. This variety is especially susceptible to the virus diseases, and before certification can be carried on, stocks must be developed that have less than 5 per cent infection of these diseases. All stocks upon which it has been necessary to work have carried 50 per cent or more. Due to the rapid spread of the disease very little progress was made prior to this year. Previous methods used consisted entirely of field roguing and tuber unit work. To decrease the percentage of mosaic other methods necessarily have been resorted to, this past year.



FIG. 119. Upper four healthy plants of British Queen variety from one tuber. Lower four plants are from one tuber, also British Queen variety. They are infected with the virus disease leafroll, which is carried by the tuber and shows no tuber symptoms, indicating the importance of seed potato buyers using certified seed.

During the winter of 1927–28 arrangements were made to tuber index several thousand tubers of White Rose to obtain, if possible, a small amount of stock with a low per cent of mosaic. This method consists in cutting a seed piece from a tuber, sufficiently large to produce a plant under controlled conditions in a greenhouse. Should the seed piece produce a healthy plant or a diseased plant, it is considered an index of the condition of the tuber. With a record kept of the seed piece and tuber, the diseased tubers are discarded and only those producing a healthy index are kept for propagation purposes.

Several lots of seed were used, consisting of stocks that had been field rogued and also stocks selected from fields showing very little mosaic. Five tons of White Rose, or 8421 tubers, 122 Bliss Triumph and 57 Garnet Chili tubers were indexed. Thirty-six hundred and thirty-three pounds of White Rose were saved for planting, 120 tubers of Bliss

Triumph and 55 tubers of Garnet Chili. The Bliss Triumph were obtained from Montana certified seed and the Garnet Chili from stock hill selected in Humboldt County.

The White Rose were planted in Shasta, Lassen, Plumas and Humboldt counties, and in the Tehachapi Mountains of Kern County, with cooperators who bore the expense of tuber indexing the seed. All stock was planted under supervision of the department by the tuber-unit method, making a total of four and three-quarters acres.

Upon inspection of this stock in the field as high as 37.0 of mosaic was found. This consisted of over 98 per cent mild mosaic, the balance being crinkle or rugose. Owing to high temperatures which indicated that a certain percentage of the mosaic was masked, it was impossible to rogue out all the mosaic from the fields. Under the humidity in Humboldt County, conditions were more favorable and it is believed the



FIG. 120. Tubers on the right weigh 8 pounds and 4 ounces and are total product of the four healthy plants in Fig. 119. Tubers on the left weigh 1 pound and 4 ounces, and are total product of four leafroll plants in Fig. 119. Leafroll greatly reduces the yield of plants infected. Certified seed is practically free from this serious disease.

stock produced from this lot will be eligible for certification next season. The balance of the stock grown in the Sierra Mountain counties will require another year of testing in the test plots conducted by the department in Humboldt County before its condition will be known definitely in respect to the virus diseases, and possibility of certification.

With better greenhouse conditions and methods, it will be possible to determine a larger percentage of the mild mosaic through tuber indexing. Also with stocks available with less mosaic and more isolation during the growing season lowering possibilities of new infection, faster progress can be made by this method. Tuber indexing, therefore, is being carried on again by the department, working largely on the White Rose or Pride of Wisconsin variety. It is fully expected that 1929 will see the first stocks of White Rose certified by the department as having less than 5 per cent of the virus diseases.



FIG. 121. A certified field of British Queen potatoes in Humboldt County, free from leafroll and other serious virus diseases



FIG. 122. Preparation room where fruit is made ready for packing. The clay pouches are prepared for the packing by sorting and grading. Fruit boxes are placed in front of each operator to receive their packed and graded. The poor specimens are thrown out, while the fruit of marketable grade is then packed in cartons for the

CANNED FRUIT STANDARDIZATION, 1928*

The season of 1928 closed the third year of operation of the California Canned Fruit Standardization Act. The law was administered as in the previous years. The state was divided into five districts, with one inspector in each under the direction of the supervising inspector.

In 1926 there were operated in the state 120 canneries packing fruit which came under the provisions of the Standardization Act. There

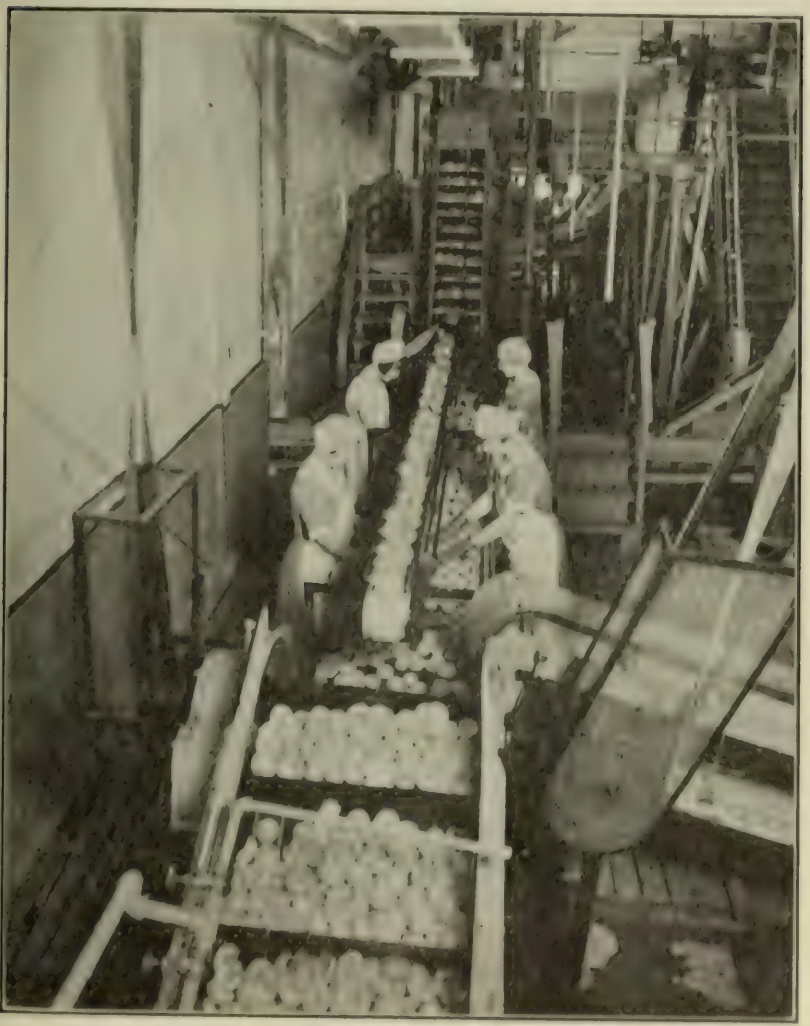


FIG. 123. Belt inspection, where blemished and poor quality fruit is thrown out after coming from washer, where all of the caustic is removed after peeling. This keeps the poor fruit, which only shows after peeling, from reaching the canning table. This inspection takes place before the fruit is put over the grader, which automatically grades the size and insures a more uniform pack.

* By W. H. Tuggle, Supervising Inspector in Charge.

was a total of 20,974,700 cases of all fruits canned in 1926. In 1927 there was a total pack of 16,775,023 canned in 115 plants as compared with 20,223,024 cases canned in 1928 by 122 canneries, divided as follows:

	1926	*1927*	*1928*
Apricots	3,390,418 cases	3,116,913 cases	2,097,070 cases
Cherries	526,520 cases	170,909 cases	280,126 cases
Pears	2,044,414 cases	1,929,805 cases	2,336,593 cases
Peaches (Freestone)	817,319 cases	320,812 cases	163,830 cases
Peaches (Cling)	13,654,758 cases	10,829,681 cases	14,811,606 cases

It will be noted that in 1928 there was a phenomenal increase in cling peaches, in spite of close grading by the canners of the fresh fruit in an endeavor to reduce the pack of the lower grades. Pears show a large increase, while apricots and cherries show a slight decrease.

The department has received uniform cooperation by all the canners. While some errors have been made by the canners, these were the exception and not the rule. All discrepancies have been adjusted between

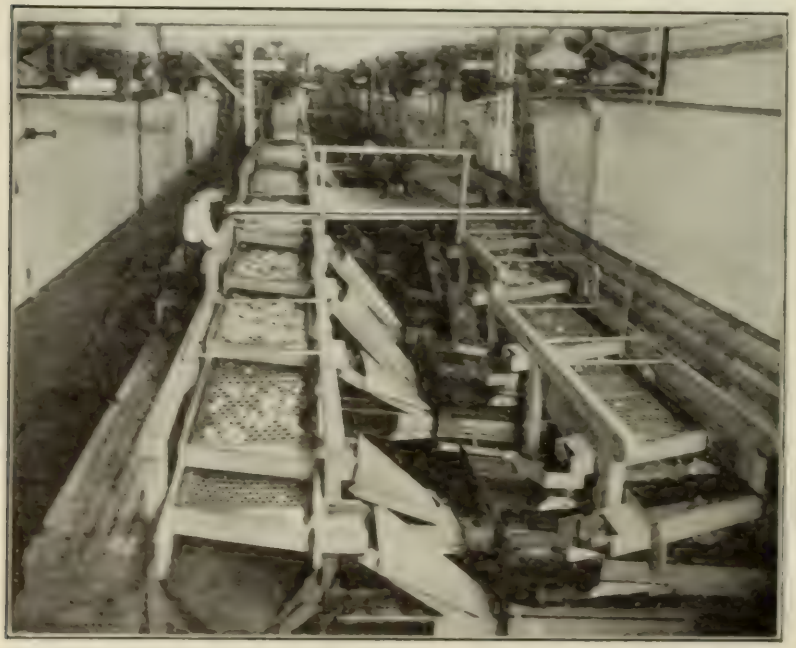


FIG. 124. Mechanical grader—conveying [illegible] of various sizes—sizing cling peaches from the grader and washer after belt inspection before going to packing tables for canning

the supervising inspector and the canners without the necessity of calling upon the board of appeal.

General approval of the law has been expressed by the industry, and it is expected that a revision strengthening certain provisions will be presented to the legislature at the coming session.

FRUIT AND VEGETABLE CERTIFICATION, 1928

By E. J. Powell, Secretary-Inspector

The shipping point inspection and certification of fruits and vegetables varies to a marked extent with the quality of the different crops, and also is influenced materially by market conditions. The general quality of most California fruits and vegetables during 1928 was distinctly below normal, this being particularly true in the case of grapes. Market conditions were very unsatisfactory throughout the year, being almost demoralized so far as grapes were concerned.

Since the greater part of the certificates written each year are on grapes, the material drop in the number of cars of this product inspected is reflected in a decrease in the total amount of business done. However, increases in other commodities, particularly lemons, apples, cauliflower and pears, to a large extent offset this decrease in grape inspections.

General inspection headquarters were maintained throughout the year at Sacramento, Los Angeles, San Francisco, Salinas and Watsonville, with temporary headquarters at thirty-two other points. Among the most important of these were Fresno, Modesto, Lodi, Truckee, Stanford, Bakersfield, Ontario, San Diego, Santa Maria, San Jose, Napa, Santa Rosa, Sebastopol and Ukiah. These offices were maintained for periods which varied from a few weeks to a number of months, according to the season of the crops covered.

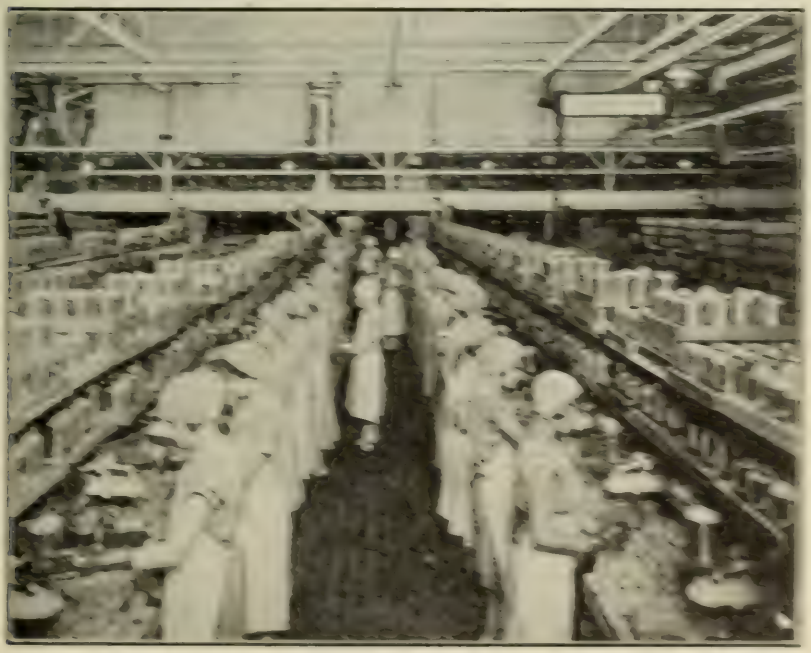


Fig. 119. Filling tank with fruit of uniform weight, size, quality and grade. After a solution of lime suspension is in tank ready for operation, citrus is added and then sealed ready for shipping.

From the first of the year until the middle of April about twenty-five permanent inspectors were employed. The force then was gradually increased until the latter part of September, when it reached a seasonal peak of more than two hundred men. A rapid decrease in grape shipments, however, resulted in reduction of this force within a week, and by the end of October the number had been cut to one hundred, being gradually reduced to the permanent crew of twenty-five by the end of the year.

CARLOT INSPECTIONS BY COMMODITIES, CALENDAR YEARS 1927 AND 1928

	1927	*1928*
Grapes	38,297	29,886
Lettuce	4,783	7,712
Apples	3,547	5,651
Tomatoes	1,880	1,850
Cauliflower	1,545	2,532
Pears	1,522	2,230
Onions	1,433	1,246
Cantaloupes	1,195	275
Celery	813	755
Peaches	775	258
Potatoes	669	729
Carrots	531	914
Others	1,073	2,005
Totals	58,063	56,043

CARLOT INSPECTIONS OF FRUIT AND VEGETABLES BY YEARS AND MONTHS JULY 1, 1920, TO DECEMBER 31, 1928

Month	*1920*	*1921*	*1922*	*1923*	*1924*	*1925*	*1926*	*1927*	*1928*
January	----	299	347	798	1,218	983	1,204	1,127	1,317
February	----	359	299	602	1,237	1,269	1,393	1,126	1,089
March	----	243	1,126	990	839	1,522	1,330	693	1,091
April	----	111	649	247	924	1,386	564	823	1,970
May	----	654	1,488	941	1,843	2,287	2,095	2,202	3,796
June	----	447	1,085	2,064	2,423	2,680	1,456	1,857	1,537
July	105	741	993	3,141	2,020	2,160	3,359	1,449	3,436
August	400	879	1,377	4,185	2,986	3,055	4,939	5,921	5,067
September	1,125	2,482	3,453	11,634	10,812	19,275	17,589	20,167	16,728
October	1,070	2,566	3,578	10,895	7,208	16,603	13,170	18,577	15,567
November	868	997	1,849	6,417	3,214	2,264	3,115	3,088	3,383
December	396	351	1,053	1,650	1,165	883	801	1,033	1,032
Totals	3,964	10,129	17,297	43,564	35,889	54,367	51,015	58,063	56,043

BUREAU OF PLANT QUARANTINE AND PEST CONTROL

W. C. JACOBSEN, Chief.

SPECIAL PROBLEMS

DURING 1928 three phases of this bureau's work demanded emergency attention, making it necessary for the Director of Agriculture to gain the approval of the Governor and the State Department of Finance to obtain emergency funds to prosecute the activities under contemplation. These were for citrus white fly, date palm scale eradication, and rodent suppression on account of plague infection.

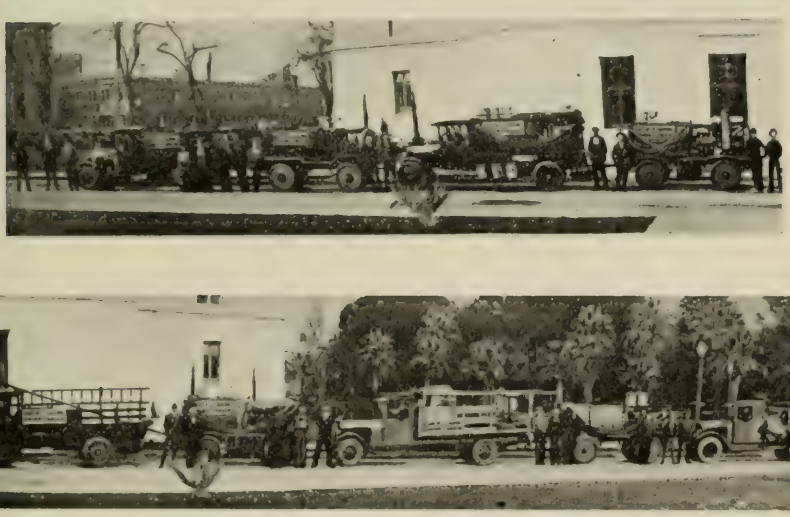


FIG. 126. Battery of spray rigs used in the citrus white fly work in Sacramento.

(a) *Citrus white fly.* In 1925, when a special appropriation was made by the legislature to inaugurate steps to eliminate citrus white fly from California, it was evident that the campaign must cover a period of years. Intensive control measures were planned to reduce infestation to the point where eradication might be hoped for. As a result of continued surveys, new spots of infestation were found and these coupled with follow-up measures on the older areas made necessary special funds. These were granted, giving an opportunity to resurvey and if necessary treat again the spot infestations found in southern California and to continue spraying operations in the northern California counties where citrus white fly had existed for a number of years or was newly found.

(b) *Date scale.* The federal government arranged for an appropriation, contingent upon the states of California and Arizona meeting the amount, for a serviceable and thorough-going inspection and eradication program for date scale eradication. B. L. Boyden of the United

States Plant Quarantine and Control Administration has been placed in charge of this project for the federal government and exercises the authority of field supervisor in this connection for the State Department of Agriculture. The sum of $25,000 was set aside to carry this work into effective operation and detailed surveys were made to locate all known plantings. The number found was far greater than previously reported, many of them being in a jungled type of growth, making an eradication project exceedingly difficult unless the plantings were either destroyed or thinned out to a point where effective inspection could be made to locate the Parlatoria scale, *Parlatoria blanchardi*, the insect under consideration. The final opportunity for eradicating this insect comes now before many of the commercially planted palms reach sufficient growth to permit a ready transfer of scale in its immature yet motile stage from one palm to the other. The feasibility of eradication before the expiration of another two-year period is most apparent.

(c) *Rodent control.* In the case of rodent control in plague infected areas, it has been recognized that the state and federal health agencies logically were responsible for suppression of this infection, which is transmissible from rodents to humans, and in instances fatal. From a cooperative viewpoint, inasmuch as the regulatory agricultural agencies, especially the State Department of Agriculture and the county horticultural commissioners, maintained an organization through which field rodent control could be effectively handled without setting up a separate agency and led to the concurrence of all interested agencies within the state, including such civic groups as the Los Angeles Chamber of Commerce and the California Development Association, the State Department of Public Health agreed to survey all possible areas for bubonic plague infection and report their findings to the Director of Agriculture. He then would instruct and cooperate with county horticultural commissioners in extending field operations to eliminate squirrels in plague infected areas. Correlating the sentiment expressed in this program, the Director of Agriculture presented the situation to the Governor and the Department of Finance, and as a result assurance was given that sufficient funds would be made available on the part of the state to cooperate with the counties and landowners in suppressing squirrels in plague infected areas.

The United States Biological Survey enters this field in the suppression of squirrels on government areas where plague is present or imminent. This, therefore, places the elimination of ground squirrels, both from an economic and health angle, up to the agricultural regulatory agencies and cooperators and leaves the technical phases of plague information and survey in the hands of the health authorities. To properly correlate all of these activities, cities must give consideration to rat problems in the vicinity of plague areas in cooperation with and under the leadership of the health authorities.

In order to utilize emergency funds for squirrel control under this plan, it will be necessary for the Director of Agriculture to enter into agreements with boards of supervisors, conducting their field operations through the rodent specialists and county horticultural commissioners, respectively. Realization of the success of this work awaits proper

special authority to the Department of Agriculture, which undoubtedly will be forthcoming during the 1929 legislature.

(d) *Fig endosepsis.* The campaign to reduce endosepsis infection in figs was carried through in accordance with the demands of the fig industry and as outlined in the eighth annual report of the department. Practically all of the vast bulk of the mamme or overwintering crop of Capri figs in the State of California were removed under the supervision of the county horticultural commissioners and through the cooperation of growers, amounting to approximately 75 tons. These were stored in Fresno under what were considered proper conditions until the profichi crop was maturing on those capri trees which had been stripped of their mamme crop. Incubation and hatching operations were then instituted in the laboratory and the blastophaga, wasps necessary for caprification, were hatched out and distributed to the several counties in accordance with the proportion requested by growers. It became evident that the numbers of figs in storage were not sufficient to produce the approximate half million tubes of wasps of 350 to 500 each as requested.

This was the first time a campaign of this sort had been attempted on so large a scale with only limited investigational work to back it up. The insistence of growers and representatives of the fig industry brought about the campaign on a state-wide basis for the winter of 1927-1928 without due consideration of some of the possible difficulties. Some of the figs in storage, because of cessation of normal activity due to severance from the mother plant, became spoiled, necessitating a constant sorting of the mamme figs in storage and consequently depleting their volume. Further, the incubators used did not produce the volume of insects anticipated; hence, the number of insects delivered amounted to about 22 per cent of those requested, although fully as many as the Fig Clean-up Committee originally estimated. This caused an appreciable shortage of profichi figs; hence a resulting shortage in Calimyrna figs.

Adriatic and Black Mission figs in orchards adjacent to those containing Capri figs proved to be of exceptional quality, with practically no endosepsis infection. As a matter of fact, a canvass of endosepsis infection later in the season indicated that the control obtained had been approximately 80 per cent; this as against the statement of the representatives of the industry that a 60 per cent control of this disease would be fully satisfactory.

While dissatisfaction was expressed on the part of a number of the growers as a result of the short crop, the Fig Institute at Madera in November, 1928, indicated that as good results were obtained as could be hoped for, considering the short time permitted for preparation, the haste with which the organization had to be formed, and the speed with which equipment had to be developed. From the viewpoint of fig endosepsis control it was quite successful, and a start having been made it is now possible for growers, either individually through local organization or through county-wide organizations, to pick up the task where the Fig Clean-up Committee brought it and continue this work for their own benefit.

PEST SPREAD PREVENTION

The principal function, as the designation of this bureau indicates, is the prevention of introduction and spread of injurious pests and diseases, not only to the extent of keeping new and dangerous pests or diseases out of the state, but also the suppression of pests found localized in sections of California and preventing their spread into sections free of same.

Dissemination of pests through the medium of shipments of agricultural commodities, including nursery stock, is of primary consideration. Hay, grain, picking boxes, even fruit itself, bear an important relationship in this field. Certain authority has been available to cover phases of pest spread prevention, but it became desirable to provide a clarified system of legislation to insure against pest dissemination in as many phases as possible.

To better understand the needs, a Nurserymen's and Growers' Committee was organized under the auspices of the Agricultural Legislative Committee, aided by the California Nurserymen's Association, the California Development Association and the Los Angeles Chamber of Commerce, with agricultural regulatory officials sitting in in an advisory capacity. This group, supplied with the necessary facts, determined that with the advent and enormous development of motor transportation in California, the statutory provisions relative to the inspection of commodities which might carry agricultural pests were rapidly becoming inadequate since the legislation at hand was based primarily on the feasibility of inspecting agricultural commodities at destination where delivered by common carriers such as railroads, express agencies, and the post office. Such common carriers no longer offered an exclusive means of transport. Private automobiles and auto trucks have supplanted them in many cases as carriers of plants and plant products. It therefore appeared necessary that provision should be made for origin inspection at sources of such agricultural commodities as could be pest infested. This committee recommended that legislation be invoked to provide:

(1) That infected or infested nursery stock or other agricultural products should be held on premises of origin after service of written notice by county horticultural commissioners or the State Department of Agriculture until any infestation or infection was eradicated or satisfactorily controlled before release.

(2) That provision be made that agricultural regulatory officers could designate what materials should be held at destination for inspection in addition to those specified in the statutes.

(3) That the licensing of dealers in nursery stock should be extended to ornamental stock and that in this connection licensees would be refused renewal of license in the event of failure to abide by pest prevention laws and regulations, or a license should be refused in the event that facts would substantiate the violation of principles involving pest spread and unethical dealings in connection with labeling stock sold.

Aside from the work of this special committee, it was recognized that insect and animal pests of agriculture and plant diseases, even weed seeds, could be transported from one locality to another *as such* with little hindrance unless the material shipped was actually infested

or infected with something else of a dangerous nature. Legislative provision was suggested to prevent the movement of pests themselves unless permit was issued by the Director of Agriculture. Exemplary in this connection is the importation of muskrats into areas in California where drainage and irrigation works could be undermined by these rodents, thereby permitting floods. Incidentally, municipalities would be subject to flood menace if muskrats were permitted to become widespread.

Also, shipments of Johnson grass seed or puncture vine seed as such could not be prevented movement unless contaminated with other noxious weed seeds. Similarly termite eradication firms or organizations have even gone so far as to advertise to supply colonies of termites for the purpose of investigation and study by schools or persons upon request. Obviously, in this manner colonies of termites could be transported into areas hitherto not bothered by this pest.

PLANT QUARANTINE

A most important contact for our plant quarantine work is the association with plant quarantine officers of the western states, British Columbia, Hawaii and Mexico through the medium of the Western Plant Quarantine Board. Not only are uniform policies in quarantine procedure established, but a thorough understanding of the pest problems in the several states and territories is gained. The proceedings of this organization have been published yearly by the department, and a recent addition is a list of pests common to each of the representative member districts, thereby avoiding the necessity of frequent correspondence to determine the presence of a pest infestation.

Incidentally, in connection with plant quarantine enforcement between the several districts and special pest control measures developed in California, it is now possible to ship early potatoes into a number of the western states when vacuum fumigated with carbon bisulphide. These modifications have led to the admission of potatoes into Canada within the year. Also, by a system of certification indicating the origin of alfalfa hay or meal made from such hay being grown in an area free of alfalfa weevil, admittance of these commodities is permitted by Canada. Isolation of the infestation of alfalfa weevil in California, coupled with the intensive border and interior inspection conducted by this state to prevent the spread of alfalfa weevil into the main alfalfa-producing areas, also were points that permitted the entrance of this commodity into Canada.

ENTOMOLOGICAL WORK

(a) *Vegetable weevil.* A special report by H. C. Lewis, assistant entomologist (resigned), has been made on the activities of the department in connection with investigational work on vegetable weevil, *Listroderes obliquus*. Since this report, a special committee representing the United States Bureau of Entomology, the Division of Entomology of the University of California, and the State Department of Agriculture was organized to correlate the activities of the several agencies directly interested. The university was able to place a full-time investigator on the problem, the United States Bureau of Entomology contributing toward necessary expense and the State Department

of Agriculture continuing survey work and the enforcement of pest control regulations to prevent spread.

(b) *Red spider.* A form of red spider was reported on grapes from the Vacaville section of Solano County and later a similar type was reported from San Joaquin County. Characteristic of this form, unknown previously, was an early attack on foliage in April, causing an appreciable searring of the grape leaves. Specimens referred to specialists for determination have revealed nothing to indicate that it is a new species, although no specific name has yet been pronounced. The department was requested to make special investigation to determine the control measures for this form and only incidental test work was possible. It is believed that intensive investigation by the specialists of the university will go into this matter another season.

In the Stockton and Modesto regions, what appeared to be the ordinary red spider, *Tetranychus pacificus*, caused trouble during the middle of the summer. The ordinary methods of control do not react favorably because of damage to vines and residue on the fruit. This likewise presents a special problem.

(c) *Leaf-footed plant bug.* An infestation having the appearance of a major pest problem occurred in the fall of the year in Imperial Valley when the western leaf-footed plant bug, *Leptoglossus* sp., was noted attacking pomegranates, tangerines, oranges and grapefruit. It was believed that this insect might be responsible for transmitting some major diseases of the fruits attacked. It was determined the insect was native in the territory and appeared in greater numbers occasionally. The owner of a property where these insects were abundant gained good control by shaking the infested trees and permitting turkeys to feed on the bugs. No serious consequences were reported, except premature rotting in the case of citrus fruits which were attacked.

(d) *Termites.* Termites gained special consideration in California through the Termite Investigations Committee, an organization composed of representatives of industries utilizing timber in their structural work, including railroads, oil companies, telegraph and telephone companies, lumber associations, etc.

The technical staffs of the university, of this department and of some of the public service corporations have been asked to assist in an advisory capacity for the guidance of the committee's work in forwarding the investigation. This is an effort to coordinate the collective energies and services of various agencies to a common end and undoubtedly will result in the development of summarized finding covering the whole field of termite morphology, life history, ecology, and methods of suppression, exceedingly difficult by individual action.

The department has been requested to assist with such legislation as would help in the enforcement of termite clean-up in areas where considerable voluntary control work is being done.

BIRD DAMAGE

Birds have been reported as appreciable factors in spoiling fruit before harvest. At the Fig Institute at Fresno in November, a special request was made for investigations of bird damage to bring up to date

an important piece of investigational work done by the United States Biological Survey about twenty years ago. New conditions have appeared to make such a study desirable and the United States Biological Survey has detailed a specialist to conduct necessary observations and studies in order that those birds causing damage may be singled out and control measures instituted.

The Secretary of Agriculture has authority under treaty provisions with Canada to provide for the control and destruction of such harmful species of birds as are listed in the category of those capable of causing crop damage.

BLISTER RUST

The gradual spread of white pine blister rust southward in Oregon, both along the coast and along the Cascade Mountains, brings the realization that California's forests may reveal infection in the white pine type of hosts before many years. George A. Root, in charge of operations in California for the United States Office of Blister Rust Control and cooperating with the California Department of Agriculture, State Board of Forestry and University of California, has submitted the following synopsis:

Since the inception of active work in blister rust control in 1924, the scope has been gradually enlarged until five separate projects were carried on during the past year.

a. *Black currant eradication:*

The season just closed marks the fifth in which this project has been under way. The counties completed this year were Alameda, Monterey, San Luis Obispo, Santa Cruz, San Francisco, San Benito, San Mateo and Kern. The total number of 198 plantings comprised 1808 bushes. This added to the number found in previous years (655 plantings with 3921 bushes), makes a grand total of 853 plantings comprising 5727 bushes. This is exclusive of those found in nurseries. Up to the present time 49 counties have been completed. The work will be continued until the state has been covered.

b. *Local control:*

This project involving the eradication of wild currants and gooseberries in certain valuable sugar pine stands has been continued for three seasons in the Stanislaus National Forest, certain portions of which are considered to be in the best range of sugar pine growth. During 1928, 8355 acres were covered, from which 260,241 bushes were removed. This work is still in an experimental stage and better methods are gradually being developed, so that in the near future it will be put on a practicable basis. It will pave the way whereby private timber owners may protect some of their sugar pine holdings.

c. *Control reconnaissance:*

This project consists of a study of sugar pine timber, in reality a cruise of the same with attending notes on wild currants and gooseberries present, and precedes the local control work, outlining those areas which would warrant protection from blister rust. Three seasons have been devoted to this project, two on the Stanislaus and one on the Plumas National Forest. In 1928, 156,573 acres were covered, which included the best sugar pine areas on this latter forest, and in

the previous two seasons 196,392 acres were covered on the Stanislaus Forest. This will gradually extend to other forests, where sugar pine is of commercial value.

d. *Ecology:*

Ecological studies bearing upon the life history of wild currants and gooseberries on various sugar pine sites were taken up and many temporary and permanent plots staked off on burned-over and logged-off land, with others in virgin timber. Studies of these plots will eventually bring to light the proper time for eradication of currants and gooseberries in offering the maximum protection at minimum costs.

The role that rodents and birds play in the dissemination of seeds must be considered and some cooperative work with the Biological Survey is being contemplated for the near future. A few preliminary studies have been made on seed caches of several species of rodents in the Sierra Nevada range.

e. *Chemical eradication:*

Since the beginning of the removal of wild currants and gooseberries as a protective measure, the use of some toxic chemical has been tried. The usual method has been "hand pulling" with the aid of grubbing implements where needed. During the past four years over 200 spray formulae have been tested as ribicides and at the conclusion of the 1928 field season, sodium chlorate has given by far the best results. A single application of a 20 per cent solution has given a 100 per cent kill on a wild currant of considerable susceptibility found in the white pine belt of northern Idaho. Several other currants and gooseberries of that region as well as two of the most common found in the sugar pine belt of this state do not succumb in the same manner, two or three applications being necessary. An ideal ribicide may be a modification of the chlorate spray or it may be a new killing agent entirely. It is quite evident that toxic spraying will not supplant "hand pulling" entirely, as its scope is limited due to topographical conditions and the greater cost on some areas.

SPREAD OF THE RUST

This year has been unusually good for the spread of the disease and for the first time it has entered the white pine belt in northern Idaho and northwestern Montana. Thus far the infections have been on wild currants and gooseberries.

One focus of pine infection was found on the west side of Mount Hood in Oregon, which undoubtedly accounts for a series of Ribes infections 30 miles to the south. The rust along the coast of Oregon extended as far south as the southern point of Lincoln County, which makes it about midway between the mouth of the Columbia River and the California line. A careful check is being kept to discoverer first signs of its entrance into this state.

COOPERATION

The cooperation extended by outside agencies and county and departmental functions engaged in similar work has been exceedingly helpful. The county horticultural commissioners in each of the counties have been of great assistance in the enforcement of matters pertaining to

plant quarantine and pest control and in turn have been given whatever assistance could be rendered by this bureau.

An instance of the value of cooperation on the part of these county officers was demonstrated in the fig endosepsis campaign, where in practically every county in which figs were produced the horticultural commissioners, aided by their staffs, undertook the survey of capri fig trees, supervised the removal of the mamme crop, and made arrangements for the distribution of the tubed wasps from the laboratory when these were ready. We acknowledge with appreciation this cooperation and also that of the following agencies:

The United States Department of Agriculture, through the Plant Quarantine and Control Administration in plant quarantine enforcement.

The Biological Survey in their development of information on the habits of rodents and the damage caused by birds.

The Bureau of Entomology in vegetable weevil and other insect control problems.

The Bureau of Plant Industry in conducting an alfalfa wilt survey and in other matters affecting plant disease control.

The Fig Clean-up Committee, which, while responsible for the endosepsis campaign, aided the department and the horticultural commissioners materially in these phases of work these two agencies were called upon to perform.

The various divisions of the College of Agriculture at Berkeley and Riverside for their helpful assistance in matters pertaining to pest control.

The State Department of Public Health for their prompt furnishing of information on plague infection among rodents.

The Hay, Grain and Feed Dealers Association for their helpfulness in preventing the spread of puncture vine through the medium of hay and grain.

The California Development Association and the Los Angeles Chamber of Commerce and similar civic organizations in the helpful development of public sentiment either through committees or members.

Many groups such as boards of supervisors, farm bureaus, railroads, fruit associations, the California Highway Commission and the Agricultural Legislative Committee have aided materially in the matter of agricultural pest prevention and control throughout the state.

In conclusion we respectfully refer to the reports of those in charge of the various services and functions in the bureau, which reports take into consideration in a detailed manner the functions and duties performed.

PLANT QUARANTINE SERVICE*

To the Plant Quarantine Service is delegated responsibility for the enforcement of the State Quarantine Law and the several quarantine orders, circulars and other regulatory measures directed against the introduction into California from other states or foreign countries of insect, disease or animal pests injurious to plant life. In addition, this service is charged with the enforcement of those state regulations or rulings directed against the further spread within the state by

* Report by A. C. Fleury, Senior Quarantine Supervisor, Sacramento, California.

commerce or travel of those serious pests now established only in limited areas in California.

All quarantine measures at the time of their issuance are given wide publicity not only to the common carrier agents but to all shippers or other persons interested in handling the restricted commodities, which results in effectively limiting the commercial movement of commodities which might carry these serious pests and proportionately limits the opportunity for inspectors to find and report the actual interception of such pests. Most of the serious insects and plant diseases hereafter reported as having been intercepted during the year usually have been taken not from large commercial shipments of infested commodities but from small lots brought in by travelers in their baggage or in automobiles, or from small noncommercial shipments expressed or mailed by individuals not familiar with the regulations. In many instances it is not possible or advisable for inspectors to carefully examine intercepted contraband plant material for the presence of pests, the prohibited commodity being immediately destroyed without examination. For example, at border highway stations during certain periods of the day a number of automobiles may be awaiting inspection and time will not permit the inspector who has just intercepted several cotton bolls to carefully examine them for cotton boll weevil or pink bollworm. Either of these serious cotton pests might be present and would be disclosed if inspection were given, but as the quarantine restrictions prohibit the admittance of this material regardless of what inspection might disclose, and its retention for the purpose of later inspection would be unsafe, it is immediately burned. The same inability to inspect in detail frequently occurs in the case of fruits found in the baggage of passengers from Hawaii or other fruit fly localities. Inspection would be hazardous and immediate burning of the seized fruit without cutting it open for examination is the only really safe procedure. Instances where inspection of contraband for the presence of pests is not possible or advisable frequently occur and unquestionably this condition results in many more actual interceptions of serious pests than are indicated by the reports. As a complete list of pests intercepted during the year at California maritime and border stations is issued as a special publication only those intercepted insects or plant diseases of outstanding importance or of an unusual nature will be mentioned here.

In past years the enforcement activities of the Plant Quarantine Service have been readily segregated into three divisions—maritime port inspection, or that dealing chiefly with ship inspection at the maritime ports; border inspection, or that dealing with the inspection of vehicular traffic at highway border stations; and interior inspection, or that dealing with the inspection of plant material from other states arriving by parcel post, express and rail freight. Modern progress in transportation methods necessitates this year a new division, namely, airplane inspection.

AIRPLANE INSPECTION

As a routine plant quarantine inspection procedure, airplane inspection started on July 1, 1928, and is carried on at present only at San Diego which has been designated as the official port of entry for pas-

senger-carrying airplanes operating on a regular schedule between Ensenada, Agua Caliente and Tijuana, Mexico, and San Francisco, Los Angeles and San Diego. During the six months that this airplane service has been in operation 350 airplanes carrying 1360 passengers from Mexico have arrived and been inspected at San Diego. The inspection carried out in cooperation with the Border Patrol of the U. S. Customs Service consists of a search of the plane and a thorough examination of the baggage of all passengers for the presence of contraband plant material. That this inspection is justified is apparent from the important interceptions of contraband plant material which have been made. The following prohibited fruits from Mexico have been intercepted in these airplanes during the period this service has been in operation, this material being found mostly in passengers' baggage: 73 grapes, 4 peaches, 14 oranges, 4 pears, 8 apples and 9 plums. Most of these are host fruits of the Mexican fruit fly. On one occasion an airplane operated by a private company, not engaged in carrying passengers, was found to be transporting fruits in its stores. This airplane—a large tri-motor—was equipped with a small refrigerator where the fruits were found in an ice compartment. The corporation operating this passenger-carrying airplane service, has cooperated in every way to bring to the attention of their pilots and passengers the provisions of the plant quarantine regulations. They have posted in a number of conspicuous places in each plane a notice advising passengers not to transport fruits or plants from Mexico.

Large tri-motor metal planes are used, each carrying twelve passengers in addition to two pilots. So far this service has been run on a regular schedule, the planes arriving daily at San Diego at a set time. This has added materially to the duties of the San Diego force, requiring on an average, the services of one inspector for half of each day. So far there has been no increase in the San Diego inspection personnel, but with the increasing interest shown in this mode of travel, indicated by the recent operation of four planes daily where but one was employed when the service started, it can be expected that this type of inspection will in the near future make greater demands upon the San Diego plant quarantine inspection force than can be met with the present personnel. These planes recognize no Sundays or holidays and inspectors must be on duty and available every day.

MARITIME PORT INSPECTION

California has eight ports of entry where vessels engaged in foreign or offshore trade discharge or take on cargo or passengers. At the three major ports—San Francisco, San Pedro (Los Angeles Harbor), and San Diego—quarantine inspectors are employed directly by the state to pass upon the admissibility of plants and plant products to insure their freedom from insect and disease pests. At the five minor ports of entry (Eureka, Monterey, San Luis Obispo, Gaviota and Ventura), at which only occasional vessels arrive, the horticultural commissioner of the county in which these ports are located, acting as State Quarantine Guardian and Collaborator of the United States Department of Agriculture, carries out the necessary plant quarantine inspection. This inspection of vessels extends to the examination

of all plant material or other commodities apt to carry plant pests transported as cargo in ship's stores or in passengers' baggage.

All of the state quarantine inspectors at the maritime ports are collaborators of the United States Department of Agriculture and the sole enforcing agents at those ports for the federal plant quarantine regulations. Under the provisions of either the state or federal quarantine regulations full authority is extended to these inspectors to board in quarantine every vessel from a foreign or offshore port, and to enter into any dock, warehouse or ship for the purpose of inspecting and passing upon the admissibility of any plant material contained therein. These state and federal regulations, which total approximately sixty in number, provide full authority for necessary action to safeguard any dangerous situation which might be found even to the extent of holding a vessel in quarantine away from the dock until it has been disinfected or the menacing condition made safe. Where conditions warrant, full authority is extended for the destruction of any material presenting a serious menace to our agriculture. There has been no increase in the port inspection personnel during the year with the exception of one additional inspector at San Pedro during the last two months.

Maritime Inspection—California Ports

	San Francisco		San Pedro		San Diego	
	1927	1928	1927	1928	1927	1928
Steamship and baggage inspection:						
Vessels inspected	3,290	3,549	3,997	4,275	799	718
Fish boats			498	403	999	934
Passengers	48,726	53,211	17,204	21,559	2,021	3,279
Horticultural imports:						
Parcels fumigated or otherwise treated	69,100	65,292	9,697	6,104	69	55
Shipments refused admittance	1,426	2,529	327	244	48	115
Contraband shipments	1,414	1,645	1,289	609	322	218
Total parcels, horticultural imports	4,257,648	5,771,116	1,485,262	1,923,787	410,521	314,927
Total shipments, horticultural imports	35,225	37,782	5,878	6,197	5,879	6,909

At the five minor ports of entry in California there were inspected in 1928, 90 vessels carrying 4 shipments of plant material.

Special precautions are taken at the maritime ports to prevent any possibility of fruits or vegetables from fruit fly infested countries or districts from entering this state. Our close proximity to the Hawaiian Islands, where occurs probably the most serious species of the fruit fly family—the Mediterranean fruit fly and the melon fly—and the daily arrival of vessels from those islands with cargo and passengers, make this probably the most important feature of the port work. This fruit fly menace, however, is not confined to travel and commerce with the Hawaiian Islands. Vessels from Mexico, Central America, South America, China, Japan, Australia, Philippine Islands and from Europe are arriving at California ports every day, and as fruit flies, as well as other serious pests, are known to occur in all of those countries constant vigilance must be maintained. The immense piles of cargo discharged from these vessels must be carefully gone over and those containing plant material or other possible carriers of plant pests must be inspected and properly disposed of. Thousands of express and parcel post packages are discharged from these vessels and all must

be opened and examined. During 1928 a total of 78,049 passengers from countries where serious fruit fly pests occur arrived at California ports and all of their baggage was examined. On every vessel the ice boxes, refrigerators, vegetable lockers and other places where fruits or vegetables are carried as ship's stores are inspected and any contraband products found are safeguarded while the vessel is within the limits of a California port by either sealing up in some tight compartment, or destruction. The crew's quarters, passengers' staterooms and every portion of each ship is carefully searched for contraband. In the examination of cargo, express and mail matter and passenger baggage from foreign countries, the plant quarantine inspectors work in conjunction with the United States Customs officers. In the case of passenger baggage, cargo, express and mail matter from Hawaii and cargo from other domestic ports such examination is made entirely by plant quarantine inspectors.

Many serious insect pests and plant diseases have been intercepted at the California maritime ports during the year. Many of these pests do not now occur in this state. Some of the more important of these findings are the interception of Mediterranean fruit fly, (*Ceratitis capitata*), on seven occasions in various fruits from the Hawaiian Islands. One interesting and unusual interception of this pest was the finding of infested papayas in the baggage of a steerage passenger, as it has been claimed that papayas are practically never attacked by this pest. The melon fly (*Bactrocera cucurbitae*), was taken on seven occasions in various vegetables from the Hawaiian Islands, principally cucumbers. The pink bollworm of cotton (*Pectinophora gossypiella*), considered the most serious pest of that crop and which does not occur in California, was taken on four occasions in raw cotton, cotton bolls and like material from Hawaii. In one instance, this pest was intercepted in raw cotton padding in a home-made pillow. Citrus canker disease (*Pseudomonas citri*), probably the most serious citrus disease known and which does not occur in California, was intercepted on several occasions on citrus fruits from China brought within the limits of a California port in violation of the quarantine regulations. The so-called nut codling moth (*Laspeyresia splendana raumurana*), was taken on two occasions in chestnuts from Japan. These are the first reported interceptions of this pest at a California port. It is recorded as a serious pest of walnuts and other nut crops and is not known to occur in the United States. Because of the recent finding in Hawaii of a serious rice boring moth (*Chilo* sp.), which had apparently been introduced from the Orient, instructions were issued to require the destruction of all rice straw arriving from Hawaii and the Orient as packing or otherwise. This rice straw is quite commonly used as a packing material for crockery and glassware from Japan and on several different occasions during the past year live larvae were found in this material. On one occasion this insect was taken from rice straw used to tie up bunches of Japanese vegetables. This rice moth is recorded as not only attacking rice but also corn and other grains and it is quite probable that it would prove a very serious pest if introduced into California. Another unusual and very important interception was citrus black fly, (*Aleurocanthus woglumi*), on citrus from Costa Rica. This insect is recorded as one of the most important pests of citrus in Central America, Cuba, the Philippines and other foreign

countries and does not now occur in the United States. At the port of San Francisco the tropical and extremely injurious termite (*Coptotermes formosanus*) was found working in the deck and other woodwork on the S. S. *Wilhelmina*. These termites had apparently established themselves on this boat and had done considerable injury before they were discovered. A large portion of the deck and the wooden partitions had to be replaced at considerable expense and this colony was eradicated, extreme care being taken to prevent the infestation from getting ashore. Many other serious insect pests and plant diseases were intercepted, some established in California, but most of them not now occurring in this state. Numerous injurious scale insects were intercepted and destroyed, amongst others being thirteen interceptions of the Dictyospermum scale on citrus fruits from Palestine, Italy, Canal Zone, China, Spain, Sicily, etc., and once on avocado budwood from Hawaii. The citrus melanose disease (*Phomopsis citri*) was reported many times on citrus from Texas, Florida and other southern states as well as from various foreign countries. Citrus white fly (*Dialeurodes citri*), mango weevil (*Sternochetus mangiferae*), injurious mites, borers, storage and household pests, weevils and many other injurious insects, as well as plant diseases, were repulsed in their attempt to gain entry to this state adding their toll to the cost of crop production.

BORDER INSPECTION

Examination of vehicular traffic, particularly automobiles and their contents, for the presence of plants, fruits and other plant products, and injurious insects being transported into California in violation of the plant quarantine regulations, is the purpose of the border inspection given on each of the principal highways leading into California from the east. During 1928 fourteen of these border stations were operated, eleven being seasonal and remaining in operation about five months during the summer when the roads they covered were not blocked by snow. The other three stations, located in the southern part of the state, remained in operation during the entire year. During the past year there was a doubled increase over 1927 in the number of automobiles passing through these border stations, as shown by the following table:

Automobiles Inspected

	1927	1928
Seasonal	73,593	89,858
Year round	125,289	140,496
Totals	198,883	230,354

This shows an increase in automobile inspection of 31,171 or approximately 16 per cent over 1927, and this condition was met with but a very slight increase in the inspection force. Such additions as were made to the force were mainly for the purpose of increasing the efficiency of that work. More time was taken by each inspector for the dual purpose of making a more thorough inspection and properly explaining to each traveler the purpose of the inspection.

At these border stations during 1928, 6243 lots of unmanifested plant material being brought into California by automobile in direct viola-

tion of the state quarantine regulations were intercepted and in addition, 1069 lots of plant material were refused admittance because of actual infestation with some serious pest or because certain specified certification or other requirement was not met. The potential menace from the great volume of plant material intercepted at these stations is indicated more clearly by the following:

Quarantine Violation Interceptions, 1928, at Border Stations

Citrus canker	3,492
Oriental fruit moth	1,182
Cotton boll weevil and pink bollworm	951
Alfalfa weevil	135
Sweet potato weevil	327
Navel orange worm	781

Many other very important miscellaneous interceptions were made, consisting in part of ten violations of the federal white pine blister rust quarantine, ten violations of the state citrus white fly quarantine, seven violations of the federal Mexican fruit fly quarantine, four violations of the federal Mexican avocado weevil quarantine, and seven violations of the state date palm law. Larvae of the Oriental fruit moth (*Laspeyresia molesta*), a very serious pest of most of the deciduous fruits and which occurs in many eastern and southern states but is not known to occur in California, were taken at the border stations on two occasions during 1928, once in pears and once in peaches from Ohio. The European earwig, which has proven such a serious household and garden pest in the Pacific Northwest, was intercepted at the Coleville station.

The eleven seasonal stations which were opened this year on May 25, somewhat earlier than usual, were located along our eastern border in the north over which travels automobile traffic coming directly from alfalfa weevil infested sections of Nevada. It is principally to prevent the introduction of that pest into the interior of California that seasonal stations were maintained. At several points the quarantine stations were located some distance back from the California-Nevada line in order that they might operate to intercept traffic moving into the interior of the state from the alfalfa weevil infested sections of northeastern California. Experience has shown that anyone camping out in sections where the weevil exists is quite apt to roll up adult weevils with bedding or tent, and in this manner innocently transport that pest over the mountains into the interior. This type of inspection has been carried on for several years and has resulted in many thousands of alfalfa weevils being shaken out of such camping equipment. The number so intercepted during the summer of 1928 was 187 taken from 71 different automobiles, which is a decided reduction in the number intercepted for several years past. This decrease probably can be accounted for mainly by the fact that most automobile travelers now stop overnight in private automobile camp grounds where cabins are available. It is seldom that the motorist finds it necessary to pitch his tent and camp upon the ground. Thus the opportunity for gathering up weevils in camping equipment is greatly lessened. Furthermore, the weevil is quite inactive when the temperature is below 60 degrees Fahrenheit and climatic conditions

this past season were not favorable to activity. Possibly the lowered severity of the infestation through natural parasites and artificial control had something to do with reducing the number intercepted. The number of weevils taken at the border stations has been decreasing steadily each year, although transportation has increased and interception methods have improved.

The inspection of automobiles and shakeout of camping equipment has resulted in the accumulation of some very interesting and valuable data on the part that such vehicular traffic plays in the long distance distribution of insects and has shown that automobiles are a very important factor in the spread of insects injurious to agriculture and must be seriously considered in any campaign directed against the spread of such pests. Many thousands of insects other than alfalfa weevils were intercepted, some of them proving equally injurious pests, many of which are not now generally distributed in this state.

While alfalfa weevil interception is the principal purpose for which these northern stations are operated, inspection is not limited to that pest. All plant quarantine regulations are enforced and all plant material carried in automobiles entering California through these stations is disposed of in accordance with these regulations.

The three southern year-round stations are located on highways which lead directly from the southern cotton and citrus growing states into the main cotton and citrus growing regions of California, and consequently because of the prevalence of the citrus canker disease and cotton boll weevil and pink bollworm of cotton in these southern states, every effort is made to prevent any of the carriers of these pests from being transported past these stations into this state. Many automobile travelers take this route through the south into California particularly during the early winter months, and as many of these motorists have never previously seen growing cotton it is a natural action on their part to pull up a few cotton plants or pick a few cotton bolls and carry such material to California as souvenirs. California is today the only cotton growing state free from the cotton boll weevil and the pink bollworm, and as cotton bolls or seed from those states where these major pests of cotton occur are quite apt to be infested with these insects this innocent transportation might result in the establishment of one or both insects in California. It is necessary that inspection extend not only to the careful examination of the automobile but also to the baggage and personal belongings of the traveler, for experience has shown that it is in suitcases, hat boxes and even vanity cases that this contraband material is frequently carried. Live cotton boll weevils which would otherwise have been transported into California have been taken many times this past year from this type of material so intercepted at these stations.

The same general condition applies in the case of citrus fruits which might be the means of introducing into this state the serious citrus canker disease which has caused such losses in several southern states. It is readily carried on the peels of citrus fruits, and under the provisions of a state quarantine order all automobiles and their contents are carefully searched and such fruits are confiscated when found.

Naturally, inspection at these stations extends to the enforcement of all state quarantine regulations and all possible carriers of agricul-

eral pests are passed upon to make certain they will not be the means of introducing pests.

INTERIOR INSPECTION

The greater volume of plant material which moves commercially into California from other states is transported by the railroads either as freight or express or by parcel post. Under the provisions of the State Quarantine Law, all common carrier agents at destination are required to hold such material until inspected and passed by a state quarantine guardian. In the case of plant material arriving by parcel post, the postal regulations require that it be held by the postmaster at destination for such inspection. Excellent cooperation has been extended, not only by the railroad and express agents, but by the postmasters in promptly reporting the arrival of and holding for inspection all such material.

This interior inspection work is carried out by the county horticultural commissioners and those deputies and inspectors who have been appointed state quarantine guardians by the Director of Agriculture. Under the provisions of section 2322*c* of the Political Code of this state, all horticultural commissioners are automatically designated state quarantine guardians, and at the request of the various horticultural commissioners, the Director of Agriculture, during the past year, appointed 264 deputy commissioners and horticultural inspectors as state quarantine guardians.

During the fiscal year ending June 30, 1928, these state quarantine guardians inspected and passed upon 54,249 shipments of plants and plant products from other states; of these, 6808 were either condemned as contraband, having been shipped into this state in direct violation of the quarantine regulations, or were refused admittance because of the presence of serious insect or disease pests. In addition to the numerous interceptions of plant material arriving in this state by rail and parcel post in violation of both the state and federal quarantine regulations, many actual interceptions of serious pests were made, among the more important being citrus white fly on several occasions, walnut husk maggot, strawberry root weevil, cherry fruit fly, peach tree borer, peach twig borer, mealy bug and various species of serious scale insects, raspberry crown borer, aphis, nematode, mites, bulb flies, storage pests, crown gall, etc.

DICTYOSPERMUM SCALE

During the latter part of 1927, certain avocado and citrus growers in this state became concerned over the Dictyospermum scale (*Chrysomphalus dictyospermi*), and the possibility of its becoming more generally distributed through the medium of palms and other host plants shipped into California from the southern states. Early in 1928 a representative of the Plant Quarantine Service was sent to Florida to investigate this situation. Based upon the information contained in his report, and that secured from other sources, quarantine enforcing inspectors in this state were instructed to make a careful inspection of the incoming plant material for the presence of this scale insect and to reject any found infested. They further advised that in those instances where inspection would be inadequate, as in the case of

palms or similar plants with imbricated leaf base structures behind which such infestation might occur and not be disclosed by inspection, fumigation with hydrocyanic acid gas should be required as a precautionary measure.

CITRUS WHITE FLY DEVELOPMENTS

During the past year citrus white fly infestation was found on many lots of plant material shipped into this state in violation of the plant quarantine regulations. In one instance Cape jessamine plants infested with this pest were sent from Louisiana to a resident of Ontario, California, and, owing to the parcel not being properly marked as to its contents, the plants were delivered and planted out without inspection. Several weeks later this condition was accidentally brought to the attention of the horticultural commissioner, and by him to the attention of this department. Immediately, steps were taken by the Pest Control Service of this bureau to destroy the infested plants and to eradicate any spread which might have occurred, by thorough spraying of all host plants in the immediate vicinity.

Later in the year, in a nursery at Altadena, citrus white fly infestation was discovered by a Los Angeles County horticultural inspector on potted dwarf lemon trees. These were traced and found to have originated in a nursery in Arcadia, where further infestation was found, not only on the dwarf lemons, but also on other hosts in the nursery and on nearby premises. It was apparent that the infestation had been in this Arcadia nursery for several years, and the sales reports, so far as available, were consulted and every effort made by the horticultural commissioner of Los Angeles County, in cooperation with this department, to trace down and locate all of the dwarf lemon trees and other hosts moved during the preceding several years from this nursery to other parts of California. As a result of this investigation, additional infestations were located at Duarte, Monrovia and Baldwin Park in Los Angeles County and Encinitas in San Diego County. Immediate eradication measures, consisting of destruction of all infested or exposed plants and the defoliation and spraying of all other host plants in the immediate vicinity, together with the voluntary cooperation extended by the owners of the nurseries and premises on which these infestations were found, obviated any necessity for placing a quarantine.

ALFALFA WEEVIL

The usual annual survey in Plumas, Lassen and Sierra counties to determine the limits of the alfalfa weevil infestation was made late in the spring of 1928. No new infestations were found, and very little spread noted. The weevil was discovered about three miles further north in the Honey Lake Valley in Lassen County, this spread being along a valley of continuous alfalfa plantings. Spraying was resorted to in those sections where the weevil has been established for several years, and but little damage was noted. The limited spread of the weevil as indicated by this survey necessitated no change in the quarantine lines which had previously been established.

In cooperation with the Nevada officials a survey was made in the Smith Valley in Lyon County in Nevada, and no weevil being found,

that valley was released from quarantine by this state until March 1, 1929. A cooperative survey in Douglas County, where Nevada officials had made an effort at eradication following the finding of the weevil there in the spring of 1927, brought to light further infestation in that county, and therefore no change in the present quarantine regulations which include Douglas County was considered.

Following the receipt of official information that the alfalfa weevil had been found in Garfield and Mesa counties, Colorado, those two counties were added to the area under quarantine by California for that pest.

ORIENTAL FRUIT MOTH

Oriental Fruit Moth Quarantine Order No. 3 was revised effective May 12, 1928, to include Ohio and Kentucky within the area under quarantine by this state for that pest. The presence of Oriental fruit moth in those two additional states was confirmed by both the officials of the states concerned and the U. S. Department of Agriculture. As previously set forth in this report, Oriental fruit moth larvae were found during the past year in both peaches and apples intercepted at California border inspection stations in automobiles from Ohio.

COLORADO POTATO BEETLE

Colorado Potato Beetle Quarantine Circular No. 5 was revised effective October 5, 1928, to permit during the period November 1 to March 1 of screening at storage cellars or other storage rooms in lieu of screening at car door, when approval for such procedure is first secured from the Director of Agriculture. Such approval is predicated upon the receipt of satisfactory assurance from the proper quarantine official of the state of origin that he, or his deputies, are able and willing properly to supervise such screening and the cartage of the potatoes from the place of screening to the car.

CHERRY FRUIT FLY IN WASHINGTON

Quarantine Circular No. 3 pertaining to the cherry fruit fly in Washington was revised effective May 3, 1928, to include the counties of King, Whatcom and Whitman, in addition to the counties of Clark and Pierce. The inclusion of this additional territory was based upon advice received from the Washington officials that the cherry fruit fly had been found in these three Washington counties.

PINK BOLLWORM OF COTTON

The most threatening outbreak of the pink bollworm since its original introduction into the United States more than ten years ago has occurred through the finding of that pest in a considerable area in western and central Texas. This newly discovered infested area which was placed under quarantine by the federal authorities, effective April 25, 1928, comprises all of nine counties and a portion of two Texas counties. This outbreak brings that pest into direct connection with the unbroken cotton belt, and unless drastic eradication measures are promptly undertaken, its natural spread will carry it rapidly through the entire cotton belt. California is rigidly enforcing the provisions of this federal quarantine and requiring that all cotton or

other commodities covered and offered for entry into this state from the infested area meet the provisions of such quarantine.

VEGETABLE WEEVIL

On March 12, 1928, Vegetable Weevil Pest Control Regulation No. 3 was revised. This revision was made necessary mainly because of the finding of this pest on a number of hosts in addition to those then under restriction, and the discovery that its distribution was more extensive than at first known. Certain changes in inspection and certification procedure were provided for.

BLACK WALNUT FLY

The presence of black walnut fly (*Rhagoletis juglandis*) in walnut plantings in Los Angeles and San Bernardino counties in the Pomona-Chino district, first became apparent in 1928. This insect, which attacks the husk in the larval stage and causes its main injury through discoloration of the shell, was the basis for Pest Control Regulation No. 5, issued October 30, 1928. This regulation restricts the movement into other portions of the state of walnuts from the regulated territory by requiring that they be entirely free from the husk or that they be treated in an approved manner to destroy any infestation which might be present. These restrictions also apply to the movement of sacks which have been used to contain such walnuts.

QUARANTINE INDEX AND SUMMARY

Formerly G. B. Laing, when horticultural commissioner of Yuba County, copyrighted and published the "Quarantine Index," which with summaries, briefed the various California and federal quarantine regulations. This publication was freely used and much consulted by the horticultural commissioners and state quarantine guardians throughout the state. He kindly assigned the copyright over to the department. As there had been changes in many of the state and federal regulations, it was decided to reprint the entire index and all summaries and furnish them as an enforcement aid to each quarantine inspection officer in the state. This was done in the summer of 1928. Much favorable comment followed the reissuance of this quarantine guide and every endeavor will be made to keep it up to date, for then only will it prove of value.

ENTOMOLOGICAL SERVICES*

The work of the department both in applied regulatory entomology and in field entomology has been extensive and varied. It is impossible to classify all activities under group headings, hence some are listed under the investigations of specific insects, while others cover more general reports on treatments of commodities.

CITRUS WHITE FLY (*Dialeurodes citri*)

Citrus white fly suppression has taken much time and money and during the year the very recent introduction of this species into southern California, together with the finding of an infestation of some eight years' standing has materially added to the problem.

* By D. B. Mackie, Senior Entomologist, Sacramento.

The first of the recent introductions came on an unmarked package of *Gardenia jasminoides* originating in Magnolia, Louisiana, addressed to and received late in September, 1927, at 807 East D Street, Ontario. Unmarked, it was not held for inspection. A friend of the receiver living in Pomona placed an order with the same firm in Louisiana; on arrival these plants (gardenias) were held, inspected and condemned, as citrus white fly infestation was found. The owner stated that a friend in Ontario had received plants from the same place and planted them. Of the original six to Ontario only two remained alive on February 2, and one of these had no foliage. The other was in a thrifty condition, having four leaves, one of which contained four living white fly larvae, with no evidence of other stages.

After a thorough study of the circumstances surrounding this case, it was decided to treat the surrounding area, so 36 blocks of residential property, including several commercial citrus groves, were completely sprayed in 52 sprayer hours.

A second introduction occurred at Laurel Canyon in Los Angeles County. A shipment of 12 small potted gardenia plants was passed by the local inspector on or about December 2, 1927, and delivered. The plants were placed on the roof of a garage until December 21, during which time some animal ate off the tops and foliage. On January 1, 1928, the remaining three plants were taken to a Beverly Hills nursery and placed in a glass propagating house. On January 2, Arthur Toyne, a former horticultural inspector on detail with the nursery, discovered larvae of citrus white fly on them. The three plants were immediately destroyed and all other gardenias (*Gardenia grandifolia*) in the nursery defoliated. There were no other host plants of citrus white fly in the propagation house at the time the infested material was placed therein. Investigation of the temperature hazard involved in the introduction was made by the county horticultural commissioner and showed that at no time during the period when the infested plants were in Laurel Canyon did the temperature exceed 58 degrees Fahrenheit, which is too low for emergence of the adult white fly. The short period (1½ days) in the humid atmosphere of the hothouse would not permit the emergence of any flies, particularly as all individuals at that time were in the larval stage.

Laurel Canyon, the site of the introduction, is a narrow canyon in the hills, with the nearest citrus grove twenty miles over the mountains, though local ornamentals and citrus could have furnished abundant host material. Only one side of the canyon has been developed into residential property, the other being a precipitous bluff covered with native growth, which includes some host plants, especially Toyon, *Photinia arbutifolia*. On March 6, ten properties were sprayed with the regular 2 per cent oil emulsion. This area included all residential property in the upper part of the canyon, and under the direct supervision of M. L. Jones, of our white fly project, a most thorough investigation and inspection was made, with no further evidence of fly.

On March 21, 1928, a third finding of citrus white fly was reported by Joseph Thorndyke, county horticultural inspector for the North Pasadena district, at the Colby Altadena Nursery, 2130 North Lake,

where a small potted citrus tree was found badly infested. The plant had come from the Arcadia branch of this nursery, and was one of thirteen delivered to the southwest corner property at Armanda and Westgate streets, Pasadena. All were found infested.

At the Arcadia Nursery, inspection revealed a well established infestation of citrus white fly, *D. citri*. The stock in this nursery yard and lath house consisted of a miscellaneous collection of ornamentals, including many preferred hosts, among the citrus being 43 dwarf lemons or limes in cans, later identified as probably Rangpur lime, an Indian species. About 100 citrus trees were found in nursery rows or cans. To the knowledge of the foreman, about 87 dwarf (Indian) limes had been in the lath house across the road for eight years. (Prior to three years ago this nursery had been owned by John Bodger, since deceased.)

All citrus present were destroyed by burning and the Arcadia nursery placed under quarantine.

K. L. Wolff, deputy horticultural commissioner, was designated to take charge of this work for the county and Cyril Gammon for the state. A later inventory of the nursery (August 1, 1927) showed 8258 host plants of citrus white fly, 5611 in containers and 2647 in the ground.

On March 27 a motor-mounted sprayer of the Department of Agriculture from Sacramento sprayed all broad-leaved evergreens in the nursery with a 2 per cent oil emulsion. A close inspection of the branch sales yards and nursery in Altadena failed to show any citrus white fly.

On March 31 both these properties were sprayed and on April 2 a hedge of dwarf citrus on the Hogan property at Porter Avenue, Altadena, was sprayed because the origin of the plants could not be definitely determined.

Running down possible carriers of white fly from the infested sales yard was conducted simultaneously with clean-up procedure by H. J. Ryan, county horticultural commissioner, and involved searching the sales record as far back as 1924.

Two dwarf citrus were located at Duarte in the Harrington subdivision on Highland Avenue which carried larval infestation. They were pulled up and burned.

On March 29 a dwarf citrus was traced to the Jordan Nursery, Baldwin Park. This was one of two purchased at Arcadia on October 25, 1927 (the other had died); as it carried larval infestation it was taken up and burned.

On April 3 F. E. Todd of this department found citrus white fly on privet on the J. E. Talley property at 380 Huntington Drive, and county inspectors on April 4 found it on the property of A. L. Parker, 400 Huntington Drive. The next day (April 5) infestation was found on the property at 418 Huntington Drive. Ryan secured permission to destroy all infested plants. Subsequent evidence indicated that infestation was carried and was not a natural spread. On April 7 all plants in adjoining and adjacent properties were sprayed.

On April 16 a potted dwarf lime located in Altadena, 1843 Mendocino Lane, was burned. This plant was purchased at Arcadia March 10, 1928, and all insects comprising the infestation were in the larval stage.

On April 17, by tracing a sales slip, it was found that six dwarf limes had been delivered to Pioneer Nursery, Monrovia, in March. Upon investigation on April 18, we found these plants infested and adult white fly emerging. As an added precaution the plants were immediately dusted with nicotine to kill adults and burned on the same day. An April 19 all host plants in the nursery were sprayed and all those listed under Quarantine Order No. 11 were placed under quarantine. On May 16, under immediate supervision of the county inspector, all host plants in the lath house under quarantine were again sprayed, and on May 22 were defoliated, with the exception of six boxwoods that were destroyed.

On April 24 a golden privet at 512 West Palm Street, Monrovia, was found infested. Only a few old leaves carried larvae, but there was evidence of adult emergence and this plant was immediately destroyed. On the 25th all hosts on the property and two adjoining were sprayed. As this property was formerly part of a commercial grove it contained many large citrus.

On April 26 there was found at 1104 La Cadena Street, Arcadia, a Valencia orange tree (about 3 feet high) set out last July, purchased from the Diamond Nursery, which showed a slight infestation. Subsequent information proved it had originated in the Arcadia salesyard. On April 27 this tree was destroyed and the premises, together with those adjoining, were sprayed.

On information furnished at the Arcadia salesyard that dwarf citrus had been sent to Seemans Nursery at Encinitas, San Diego County, R. R. McLean, county horticultural commissioner, was able to locate the stock, which was found to carry infestation. This nursery was immediately placed under quarantine and sprayed on April 3 under the supervision of the State Department of Agriculture.

On May 4 the Los Angeles County horticultural commissioner's office made a check of the host plants, name and number. This list was based on Quarantine No. 11, and showed 4452 host plants. A supplementary list based on the state's host list to date included 213 more host plants.

Permission to destroy host plants at the Arcadia nursery was secured on May 26, 1928, by Deputy Horticultural Commissioner Wolff. It was found that to make procedure legally correct the nursery must be made a white fly area, which was done by proclamation June 9, 1928; grubbing out the plants and burning started June 18 and was completed the same week. There were still left in the nursery 273 plants based on the supplemental host list of the State Department of Agriculture, May, 1927, and these were destroyed July 17, 1928, thus completing the preliminary work of treatment and destruction of host plants.

During the period following the clean-up, intensive inspection was made in all localities where the white fly had been found. This was followed up with respraying of all properties where white fly was found, and also adjoining properties were sprayed. In some cases this was extended still further. No living white fly was found on the Harrington place at Duarte. Dead larvae, presumably destroyed by the spraying of April 2, were found on an orange tree located some feet from the infested dwarf citrus. The finding, however, is evidence that the species had spread from the original infestation. Since our spray-

ing, no living white fly has been found in any of the former sites. The last inspection was made between July 16 and 24. Lack of funds hampered the further work of checking or inspection during the summer. It is interesting to record that the citrus white fly was intercepted not less than three times during 1928 on gardenia—at Pomona, Los Angeles County; Hemet, Riverside County, and Oroville, Butte County.

Early in the year infestation appeared at Hammonton, Yuba County, where only eighty host trees were found.

A spot infestation not previously reported was found in Yuba County.

In the control area in Sacramento and Marysville-Yuba City areas the results of spraying have been reported in a special article which appeared in the Monthly Bulletin report for the calendar year of 1927.

With the completion of the spraying season of 1928 the special fund created to finance the white fly work became depleted and all work was discontinued, making impossible further summer inspection. In October a special fund of $18,900 was made available to finance this project and the spraying started about December 15, but weather conditions hindered the application of spray material this year.

To safeguard against new white fly establishment in the southern part of the state it is considered advisable to regularly inspect citrus orchards in the localities where infestation was noted, and perhaps for several seasons to follow up with spraying in parts of Los Angeles, San Diego and San Bernardino counties.

The further finding of white fly in Oroville as a result of inspections raises the question as to whether it was eradicated there in 1907. The evidence is about equal both ways. Only a scattering infestation exists, the insect having been found at twelve different sites in the city limits, one in a district outside of the zone of the 1907 eradication measures. It was also found in the courthouse yard, where the trees were given a fumigation under tents and not cut back or defoliated. The infested blocks are scattered, being at both ends of the city and in the center. It may be said with equal assurance that after a period of twenty years it is natural to assume that a heavier and more general infestation would be present, and that it would have been found in the natural course of inspections made from time to time.

The situation in regular areas of infestation is presented by a series of graphs, which cover such data as can be presented in this manner.

From the standpoint of bringing about a numerical reduction in the white fly population, experience points to the fact that this could be accomplished by a summer and winter campaign. Such process, however, would be costly, as there would be an added number of summer hosts which would have to be sprayed and much trouble would arise from unavoidable damage to flower beds and gardens.

A very material decrease has been affected in insecticide costs along two different lines; one in the reduced price of standard commercial compounds, the other by developing special emulsions that can be purchased at lower costs. Where insecticides formerly cost $1 per gallon, the price during the present season is 22.8 cents per gallon f. o. b. Sacramento.

Further advancement in sprayer efficiency and accessories has been made by the equipment of three sprayers with combination guns which remove entirely the delays caused by changing from pole to gun. In

ordinary spraying these changes occur from 36 to 75 times per day of eight hours, with one minute as the most rapid change possible. Twelve such guns are in operation.

At the close of the calendar year, including the build-up during the summer, it is believed conservative to say that the reduction is better than 99 per cent in all treated areas.

WALNUT HUSK FLY, *Rhagoletis juglandis*

Our report made in 1926 that walnut fly, *Rhagoletis juglandis,* was present in California in the Chino-Pomona district, has been confirmed by the rearing of specimens by Armitage at Los Angeles which have been identified. Delay in establishing its identity was due to the fact that larvae sent for determination in 1926 to Prof. H. J. Quayle at Riverside as representing the species were in reality a scavenger, *Euxesta notata,* which is common in infested nuts and gains admission after the operation of the walnut fly has caused a decayed area to appear in the nut husks. This walnut fly is one of the Trypetidae or true fruit flies. The genus to which it belongs includes two other destructive species, both native to the United States, the so-called railroad worm, and the cherry fruit fly; respectively, *Rhagoletis pomonella* and *R. cingulata.*

This species of walnut fly was first described from cultivated walnuts in Arizona. It is recorded from an introduced host, and has not yet been found in the native black walnuts in the Chino district. It has a single annual brood, though there is evidence that a small portion of the pupae do not emerge till the second year.

Immediately following the report of the introduction, Cyril Gammon, field assistant, was assigned to make a survey as to its possible distribution and to test out possible methods of treatment for so-called "stick-tights," or walnuts with part of the husk adhering to them, as it has been found that such nuts may act as carriers of the pupae to new districts. As a direct result of his inspections, infested groves in Pomona, Spadra and Walnut have been found.

Test treatments of "stick-tights" to determine the possibility of treating all such walnuts as a condition of certification or movement have involved a wide group:

1. Dipping in the standard walnut bleaching solution.
2. Vacuum fumigation with hydrocyanic acid.
3. Vacuum fumigation with carbon disulfide.
4. Atmospheric fumigation with hydrocyanic acid.
5. Hot water treatments at a temperature varying from 110 to 125 degrees Fahrenheit.
6. Hot air treatments.
7. Steam treatments.

In some of these cases 100 per cent kill was obtained and especially in one case of vacuum fumigation 100 per cent kill was evident. Other tests have not been given the final check, as time sufficient to determine results has not elapsed.

Among the hot air treatments, 15 hours at 112 degrees secured 100 per cent in one type of dehydrator. This is applicable to green nuts only as when applied to dried nuts the kernels are visibly affected.

A steam treatment whereby the nuts are exposed to hot vapor at a maximum of 210 degrees Fahrenheit for 100 seconds offers considerable promise and in preliminary tests has produced a complete kill of pupae placed beneath the husk of walnuts so exposed. No injury to the flavor of the nuts is noticeable. While this treatment lends itself to packing house procedure, it is not practicable for treatment on the ranch. While it may be considered desirable to develop a ranch treatment, any decentralization of treatment would tend to increase the hazard of distribution.

The fact can not be ignored that any program looking to the control of distribution of this species will meet with many obstacles, due to the great difficulty in controlling the host channels.

Rhagoletis juglandis is the first fruit fly of economic importance to be introduced into the state, and if present indications are confirmed, a well-developed program of control will have to be developed and carried out to prevent serious injury.

VEGETABLE WEEVIL, *Listroderes obliquus*

Work with this species has been in the nature of a continuation of last year's program. Two separate surveys were run, the first in the early part of the year, and the second in December. These covered eighteen counties, eight of which were found infested. Napa and Santa Cruz counties were added to the list of those previously infested. During the second survey no new territory was added, but the species was found for the first time on a native aster, *Aster chilensis*, which, from preliminary observation, seems to be a favored host.

Intensive field observations on the seasonal activities of the weevil were conducted by assistants Lewis* and Gammon. These covered particularly the seasonal activity of the weevil, its aestivation in the summer and emergence in the early winter.

A number of field applications of poison bait have been made and about seven acres treated in Santa Cruz and Santa Clara counties.

During 1928 thirty-two different kinds of bait were prepared and tests made in an endeavor to secure a compound attractive to the adult weevils, and discover to what extent they will leave their native hosts and food plants to come to it. As high as 90 per cent kill has been obtained in cage tests with preferred foods available.

In connection with the treatment of vegetables with different fumigants to destroy possible weevil (larval) infestation, investigations have been made to test the adaptability of two compounds by vacuum fumigation. These compounds were:

1. Carbon disulfide, plus carbon dioxide.
2. Ethylene dichloride.

In each case the following vegetables were tried:

1. Broccoli.
2. Spinach.
3. Turnips (white).
4. Carrots (bunches).
5. Asparagus.
6. Cabbage.
7. Celery.
8. Beets.
9. Lettuce.

Tests with carbon disulfide plus carbon dioxide CS_2+CO_2 were carried out at the standard schedules for tuber moth. The tuberous rooted

vegetables apparently had considerable resistance to the effects of fumigation. A number of them are sold with their tops on and these leafy parts were injured to the point of affecting their sale value, as they show a rapid decomposition and slimy rot. Broccoli, while not apparently injured, took on a rich yellow color and when cooked had a decided difference in taste from the untreated. Beets, also, while showing no injury, developed a decidedly unnatural taste.

In the tests with ethylene dichloride even more severe injury was noted than with carbon disulfide. In this treatment the color of certain vegetables was visibly affected. Asparagus treated for one hour at standard schedules shows a distinct rose color.

It is very desirable that a treatment be developed to effect control of this species when in the larval stage. There remains still one possible utility, ethylene oxide, a supply of which has been secured from the United States Bureau of Entomology through courtesy of Perez Simmons, in charge of the dried fruit insect laboratory at Fresno.

POTATO TUBER MOTH, *Phthorimaea operculella*

To prevent potatoes acting as carriers of tuber moth, four vacuum fumigators have been available for treating them, one a new plant at Del Monte Junction.

Since this fumigation has proved so satisfactory, there seems to be a general tendency to discontinue the certification of potatoes as to origin in fields free from moth infestation, and make vacuum fumigation mandatory for all potatoes from this state. During the year the state of Utah has changed to include such provisions and the Canadian government has lifted its embargo on California potatoes and now will accept the California certificate of fumigation.

Regulations governing this treatment provide that only potatoes apparently free from tuber moth infestation shall be allowed movement, the basis for tolerance by fumigation being that the fumigation can reasonably be relied upon to take care of that hazard lying beyond human ability to inspect for this insidious species.

Further it is entirely erroneous to believe that the California Department of Agriculture establishes the regulations on early potatoes, as our only motive is to conserve all possible markets for this crop.

During 1928, 257½ carloads moved under fumigation certificate. Not one ton of these could have moved without the fumigation methods. These were sent to the following states:

Oregon	158	cars
Washington	35	cars
Utah	25½	cars
Idaho	7	cars
Canada	2	cars
L. C. L. miscellaneous	30	cars
Total	257½	cars

TREATMENTS

Vacuum fumigation tests have been made with a number of the newer insecticides, particularly with a view to securing information on what concentrations are liable to explosion. Compounds thus tested are:

1. Carbon disulfide in combination with nitrogen.
2. Ethylene dichloride.
3. Ethyl formate.
4. Ethylene bromide.

Of particular interest is the development of nitrogen in combination with carbon disulfide to reduce explosion hazard. It has been our belief that this compound would lend itself for use in this combination and would be free from the undesirable feature of freezing, which causes trouble with carbon dioxide in cool weather. Cost has been the limiting factor, but a source of commercial nitrogen recently has been developed. Investigations made confirmed our previous belief and show that the value of this gas parallels carbon dioxide. As a result of these findings, four commercial fumigators have been equipped for use of the nitrogen combination in the treatment of potatoes, dried fruit and almonds.

In the development of vacuum fumigation in California, one new potato fumigator has been installed at Del Monte Junction and a second plant, the largest in the state, has been built for commercial purposes at San Francisco by the California Cotton Mills. The latter is equipped to treat with either hydrocyanic acid gas, carbon disulfide, or formaldehyde. Five approved fumigation plants for the treatment of potatoes in interstate commerce now are available. For shipments originating within their respective counties, two more can be added. During the year nursery stocks have been certified for movement after treatment by vacuum fumigation as follows (records furnished by horticultural commissioners):

VENTURA COUNTY

For planting in county:	
Walnuts	22,473
Orange (Valencia)	80,587
Orange (Navel)	10,029
Lemon	13,645
Tangerine	75
Grapefruit	4,304
Total	131,113
Seed bed stock	113,100

ORANGE COUNTY

Citrus	26,778
Avocado	1,025
Deciduous	5,960
Ornamentals	795
Seed bed stock	19,800
Total	54,358

LOS ANGELES (Commercial Unit)

Citrus and ornamentals	21,000
Seed bed stock	132,900
Nursery stock (trees)	386,671
Total plants	519,571
Grand total	818,142

To prevent picking boxes acting as carriers of mealybugs, there have been several additions to treating equipment, notably a large double tunnel outfit at La Verne Citrus Growers Association and also one at the Canoga Citrus Association at Owensmouth, Los Angeles County. It has been possible to fix a standard schedule, which is a temperature of not less than 210 degrees in the tunnel, with an exposure of the boxes thereto for not less than 100 seconds. All sterilizers are to be equipped with heat controls.

DATE PALM SCALE, *Parlatoria blanchardi*

During the year the state has made available $25,000 in emergency funds, which in combination with a federal appropriation, are to be used in the eradication of Parlatoria scale.

Under cooperative arrangement this office will work on the investigation of different treatments of offshoots to destroy possible infestation by this insect. This work has been planned with the United States Plant Quarantine and Control Administration and their representative in charge at Indio, B. L. Boyden.

ELM LEAF BEETLE, *Galerucella luteola*

There has been a considerable spread since the original finding of elm leaf beetle in Fresno. The general area where infestations may be found would cover a belt in the San Joaquin Valley extending from Merced to a point below Bakersfield.

In July, 1928, the beetle was taken at Roseville, Placer County, under conditions that seem to point to its presence there for two or three years. Practically every elm tree in Roseville showed infestation.

This new location carries more potential danger than any heretofore recorded, due to its proximity to Sacramento, with an elm tree population probably greater than any other city in California.

The problem of adequate spraying will require decisive action by each city having elms, as this species under California conditions is relatively more destructive than in the eastern states, because of the long period of summer weather giving rise to numerous generations of beetles. This, together with the lack of summer rains, plus high temperatures, makes for continual defoliation, with no chance for recovery and intense injury from sunburn. There are few elm trees which can stand two consecutive years of defoliation, while a large portion of those growing under urban conditions on streets will be killed by the first complete defoliation. A city can protect its trees by spraying and keep them or can delay spraying and lose them. In either case there is a cost burden attached, but the cost of removal of large city trees is vastly in excess of the cost of spraying. In fact, the annual interest on the sum required to take out a large elm tree under city conditions will provide for its annual spraying, save the tree and assure it adequate protection against the beetle.

Spraying of shade and park trees is an entirely different problem from orchard spraying and requires much heavier and more powerful equipment and accessories, but when properly done the cost is not excessive.

ALFALFA WEEVIL, *Phytonomus posticus*

This office participated in the annual survey to determine the spread of this species, jointly with the quarantine office in Honey Lake, Long and Sierra valleys and other sections of Lassen, Plumas and Sierra counties. There has been a rather limited spread during 1928.

EUROPEAN EARWIG, *Forficula auricularia*

This species has been taken during 1928 in San Francisco, and Orick in Humboldt County, showing spread also in the older areas of infestation.

A quarantine around the infested district, without complete restriction, has been suggested against all products from the infested districts of Oregon and Washington. However, any regulation would fail, because countless means of carriage in addition to those which can be covered by quarantine procedure make this impractical.

MISCELLANEOUS ACTIVITIES

These include applications for testing insecticides, information as to the identity of noxious species and assistance in the control of specific insects. Testing of insecticides has been limited in its scope and devoted largely to special compounds that show possibilities of possessing merit over present practice. In this connection tests have been made with certain contact compounds of the pyrethrum group, both against the Harlequin cabbage bug and bean thrips on pears, which have been reported under special reports.

Work also has been done with two types of carbon disulfide emulsions used as soil fumigants against white grubs. Certain oil compounds have been tried against the mealy plum louse with a view to developing a timely spray program before the fruit matured to the extent that the insecticide containing oil removes the bloom.

Park elms at Oroville and Marysville have been treated to control European elm scale in cooperation with the city government and in exchange for water supplied in the white fly campaign.

Extensive tests were made with oil emulsions in an effort to reduce cost of material used against citrus white fly.

We have cooperated with the Western Plant Quarantine Board, particularly in connection with mandatory treatment as a condition of interstate movement of agricultural products. At the tenth annual conference of that body we presented a manuscript of the data compiled on this subject. The results were evidenced during the year in the opening for the first time of the markets of Canada to California potatoes. Among other important considerations before that board is the possibility of developing methods of milling and handling alfalfa meal that will assure against carrying alfalfa weevil throughout the year.

During August the Senior Entomologist attended the Fourth International Congress of Entomology at Cornell University, Ithaca, New York, and while there studied methods in the control of a number of the more important foreign insects established in the eastern United States.

Fourteen states were visited, and first-hand information obtained on European corn borer, satin moth, European earwig, gypsy moth, browntail moth, hag moth, apple and thorn skeletonizer, Japanese

beetle, white pine blister rust and Oriental fruit moth. It was also possible to study methods applied by the United States Plant Quarantine and Control Administration in the treatment at the ports of New York and Boston of cotton, broom corn and European chestnuts.

At the Cornell conference the rare opportunity was afforded to confer with foreign entomologists from 27 different countries relative to problems of mutual interest, and assurance of future exchange of information, obtainable in no other way, was gained.

Requests for information and assistance from a number of different states and foreign countries, limited largely to vacuum fumigation and bulb dipping equipment, have been received. We have handled six sets of suggestions on vacuum fumigators, these being divided as follows: 4 to Syria, Smyrna and vicinity; 4 to Iraq, Basra and vicinity; 2 to South Africa; 2 to Portuguese East Africa. The tolerance induction by the federal government on imported dried fruits, especially figs, has undoubtedly created a serious interest in this method.

There have been no untoward outbreaks of insects during the year to cause particularly heavy losses. One species, the Great Basin tent caterpillar, appeared in unusual numbers all along the Sierra Nevadas, but confined its attack largely to wild plants mostly of the genus Ceanothus, though in Lassen County it was reported feeding on prune foliage.

A number of changes have been made in personnel. Harry Stiner, field assistant, was succeeded by Clifford Clower in January. Frank E. Todd, entomologist, was transferred from the white fly project to assume charge of apiary inspection. In August Hartford H. Keifer was appointed laboratory assistant, taking charge of the collection and identification work. Harold C. Lewis, assistant entomologist, with the department five years, resigned to take effect December 1.

PLANT PATHOLOGY*

VIRUS DISEASE OF ROSES

Following a report from eastern recipients of rose stock propagated in California to the effect that some of such stock was infected with a disease of a chlorotic and virus nature, a search was made in nurseries and elsewhere by this office to ascertain whether or not virus diseases were in roses in California. At first, the search was centered upon rose plants in those districts in which the stock was reported to have been propagated and in which much of that industry has been centralized. Those districts lie in Alameda, San Francisco, San Mateo and Santa Clara counties. Later, the search was extended into Southern California. Plants in greenhouse and field were examined. The results of the searches indicate that there was no visible evidence of an infectious virus disease on roses in this state.

In the course of the search, plants were examined at four different periods extending over the propagating season. Particular attention was given to Manetti root stock on which the reported diseased plants had been budded. In addition, the mother plants (Madame Butterfly and Premier) from which the buds had been taken were kept under observation.

* Report by D. G. Milbrath, Senior Plant Pathologist, Sacramento.

In one instance, a few suspicious plants in a greenhouse were found and an infection test was planned and carried out. The stock consisted of roots of Manetti and tops of Claudius Pernet. Aphids (*Myzus rosarum and Macrosiphum rosae*) were collected from rose plants of normal appearance and in a location remote from the greenhouse with the suspected plants. About half of the lot of aphids was permitted to feed on the leaves of suspected plants for a period of 48 hours. They were then transferred to apparently normal, young and vigorously growing plants (Madame Butterfly on Manetti roots) held under control in muslin covered cages. The other half of the aphids which were considered noninfectivorous was transferred to similar plants in another cage. As a further check, plants were held in a third cage without exposure to aphids. Observations during a period of six months led to the conclusion that the chlorotic condition, originally found, was not transmissible by means of aphids, the carriers employed.

TOMATO CANKER

This office was informed in September by Michael Shapovalov, U. S. Department of Agriculture, of his discovery of the disease known as bacterial canker in two fields of tomatoes in this state. A further and extended search by him did not disclose any other infected fields. One of the fields reported was situated in Stanislaus County and contained Red Pear and Stone varieties of tomatoes; the other field was situated in Ventura County and contained Globe and Stone varieties.

This disease is caused by the bacterium *Aplanobacter michiganene*. The infectious causal organism can be carried on the seed. When the disease has gained a foothold in a community it spreads very readily, as shown by the wide distribution in other states.

On receipt of the report, this office communicated immediately with the horticultural commissioners of the two counties concerned and solicited cooperation in an attempt to prevent the spread of the disease. In both instances, owners of the fields agreed to forego planting tomatoes on the involved land for several years at least.

OZONIUM ROOT ROT

In August, 1928, this office was informed of an infection by *Ozonium omnivorum* in the soil of the government date gardens at Indio. An investigation was made immediately. It was found that the soil of an area of about four acres presented a case of definite infection.

To ascertain the distribution of the fungus in California, C. E. Scott was assigned to make a survey of those parts of the state where conditions might be favorable for existence of the parasite. In the months of August and September, the period of the year in which evidence of infection in host plants can be detected most readily, the survey was extended over Coachella Valley, Imperial Valley and the Colorado River lands near Blythe, Yuma and the northern portion of Lower California, Mexico. Data collected have been submitted and filed in the department in the form of a detailed report by Mr. Scott.

A brief summary of that report is as follows: "With the exception of the Indio case, root rot is known only on the recent alluvial soils of the Colorado River in the Palo Verde (Blythe) and San Pasqual (Bard) valleys of California." No case of root rot outside of the

government date gardens was found in Coachella Valley. In Imperial Valley nothing indicative of Ozonium root rot was found. It is very apparent that the infection at Indio is the only one in Coachella and Imperial valleys. The soil at Indio is not a very recent alluvial deposit as in Palo Verde Valley, San Pasqual Valley and the lands of the Colorado River in northern Mexico. In the last mentioned places the fungus could have been either indigenous or introduced with flood waters, but in the Indio case no such theory can be entertained and the most logical surmise is that the disease was introduced by means of plants carried in from infected areas. Investigations by this office have been started to determine the best and most feasible methods of eradication of the pest now localized at Indio, and recommendations for such eradication will be made.

CORYNEUM CANKER OF CYPRESS

Observations during the past two or three years indicated a decided increase in losses among the Monterey cypress trees in ornamental and hedge plantings in the vicinity of the south end of San Francisco Bay. Investigations made by the office of Forest Pathology (U. S. D. A.) of San Francisco revealed the presence of a hitherto unknown fungus, to which was subsequently assigned the damage noted. This disease is also found to some extent on Italian cypress.

The records of this office now show Coryneum canker on cypress trees in the following counties: Alameda, Contra Costa, Solano, Sacramento, Marin, San Francisco, San Mateo, Santa Clara, Monterey, Santa Barbara, Los Angeles and Riverside. The disease has not as yet been noted in the vicinity of the native trees on the Monterey peninsula.

The value of the Monterey cypress as an ornamental and as wind breaks, particularly for the citrus groves, justifies considerable effort to prevent further spread of this destructive disease and keep it under control where it is already established. In cooperation with our Nursery Service, a special effort is being made to locate all infected nursery stock and destruction has been advised. Where old trees have been found infected, destruction by burning is advised to prevent spread.

ALFALFA WILT

A disease known as bacterial wilt of alfalfa was reported as causing injury to alfalfa in fields of the State Land Settlement at Delhi. When this report of the presence of the disease first became known, it was accepted by agricultural interests as a single case which endangered the remainder of the community through the possibility of spread to uninfected lands. A request for a quarantine on the lands of the State Settlement followed. At a conference on the matter of controlling the disease in place and of prevention of spread, it was suggested that a survey should be made to determine its distribution in the state. In an unofficial report from Dr. J. L. Weimer, U. S. Department of Agriculture, who made such a survey, it became known that a condition of alfalfa resembling bacterial wilt was widespread in the territory lying south of Stockton and extending to the southern border of the state. The examinations of plants were made in the field. In laboratory diagnosis of similar specimens it became evident that general symptoms of the disease were not always accompanied by the organism *Bacterium*

insidiosum. As a result, a new situation has arisen which must be cleared up before definite recommendations of control and spread can be made. The parts played by early cutting, pasturing, rendering and irrigation in the creation of the condition of alfalfa in some fields in the state must be correlated with the symptoms which the bacterium is capable of producing.

SCLEROTIUM ROLFSII

The first recorded find in California of *Sclerotium rolfsii* was in a lippia lawn in the gardens of the U. S. Cotton Field Station at Shafter. Owing to the large amount of injury caused to various major crops by this fungus in the southeastern states a program of eradication was recommended and was carried out jointly by this office, the office of the horticultural commissioner of Kern County and the officers in charge of the government station at Shafter.

The plan of eradication consisted of destruction of the host, application of an agent which might be toxic to the fungus and plowing under the top layer of soil. Destruction of the host was necessary to deprive the parasite of substance. This was accomplished by spraying 800 gallons of crude oil, 33 degrees plus Baume, over an area of about 24,000 square feet. The oil was ignited and permitted to burn. The penetration of heat into the soil was not sufficient to kill and destroy all roots of the host, although the roots rarely were deeper than four inches. To supplement the heat, carbon disulphide was injected into the soil to a depth of two inches. It was expected that the chemical might have some toxic effect on the mycelium and sclerotial bodies of the fungus in the soil. About two months later the whole area was plowed under to a depth of 8 to 10 inches. *Sclerotium rolfsii* is not a deep soil fungus; in fact, Taubenhaus reports failure to obtain activity of the fungus in soil at a depth below five inches.

It is apparent that soil moisture was the most important influence favoring the development of the disease. Failure of the fungus to spread over a wider range than it covered undoubtedly was due to insufficient moisture in the surface layer of soil adjoining the infected area. Dessication will be the concluding step in the program of eradication.

FIG ENDOSEPSIS

The campaign to reduce endosepsis in figs was carried out in 1928 as outlined in the eighth report of the California Department of Agriculture. The activities of this office in that campaign were varied and in the main consisted largely of coordinating the several agencies associated. C. E. Scott, Assistant Plant Pathologist, acted as secretary of the Fig Clean-up Committee. He assisted in directing the survey, locating Capri fig trees and compiling reports. Samples of figs were examined in the laboratory for horticultural commissioners and the findings were made available for basis of abatement proceedings. During the treatment period, Scott assisted in organizing the work of handling figs and wasps at the Fresno insectary for a period of about six weeks.

LABORATORY DIAGNOSIS

One of the chief functions of the office of plant pathology is the diagnosis of pathological plant specimens as a means of assisting law

enforcement officers of the state and counties. Our aim has been to carry out the diagnosis and report results as expeditiously as possible without sacrificing accuracy.

During the year about 800 specimens were placed on record. In addition large numbers were presented for diagnosis in a less official manner by nonofficial persons calling at the laboratory. The host list of specimens recorded and received follows:

Abelia, Acacia, Adiantum, Alfalfa, Almond, Amaryllis, Anemone, Annis, Apricot, Apple, Arborvitae, Aspidistra, Asparagus, Aster, Aucuba, Avocado, Balm of Gilead, Banana, Bean, Berberis, Birch, Blackberry, Boxwood, Broom, Cabbage, Cactus, Calla Lily, Camellia, Carrot, Cassia, Cauliflower, Ceanothus, Celery, Cestrum, Cherry, Chestnut, Clematis, Clover, Cocos, Coffee Plants, Coleus, Coron, Cotoneaster, Cotton, Cottonwood, Crataegus, Currant, Cypress, Dahlia, Daphne, Dogwood, Eucalyptus, Euonymus, Euphorbia, Fig, Freezia, Gardenia, Garlic, Geranium, Gladiolus, Grape, Hippeastrum, Hop, Hemp, Hypericum, Hyacinth, Iris, Ixia, Jasmine, Juniper, Kale, Kudzu, Larkspur, Lemon, Leucojum, Leucothoe, Lilac, Loganberry, Lonicera, Magnolia, Mint, Myrobolan, Narcissus, Nectarine, Oak, Oleander, Olive, Orange, Oregon Grape, Pansy, Parsnip, Pear, Pea (garden), Peach, Peony, Pepper, Persimmon, Phoenix Canariensis, Phlox, Pine, Pittosporum, Plum, Poinsettia, Pomelo, Pomegranate, Poplar, Potato, Privet, Prune, Pyracantha, Quince, Radish, Ranunculus, Raspberry, Rhubarb, Rose, Snowball (Japanese), Sparaxis, Strawberry, Sugar Beet, Sweet Potato, Sweet Pea, Sycamore, Tomato, Trumpet Flower, Tulip, Tuberose, Turf (Golf Greens), Turnip and Walnut.

This list includes a wide range of plants, some of which are ornamentals and might be regarded as having little importance in the realm of agriculture. It is well known, however, that many plants accepted as purely ornamental can carry some of the diseases affecting agricultural crops.

RODENT CONTROL*

For administrative control purposes the offices pertaining to rodent and weed control have been combined under one superintendent. Because of the close association of duties in these two activities in the field, it seems desirable that they be thus continued until weed work reaches a growth where it will be difficult for one man to keep sufficiently in touch with all angles of this important phase of pest control.

MUSKRATS

Ground squirrels, pocket gophers, rats and rabbits still retain first rank in economic importance in California, with some additional attention to muskrats because of the surprising increase in interest in this animal from the angle of fur farming.

Generally speaking, muskrats provide an appreciable potential menace to agriculture in the interior valleys and in other sections of California where irrigation and reclamation works provide levees and embankments for the retention of flowing water. It has therefore been necessary for the State Department of Agriculture to cooperate with the Fish and Game Division of the Department of Natural

* By C. Olsen, Superintendent, Rodent and Weed Control, Sacramento.

Resources with a view to limiting muskrat farming to areas where no evident menace can result.

Muskrats are native in territories beyond the eastern mountain ranges which shut California off from the Great Basin and deserts of the southwest. The developing interest in raising these animals for fur, however, has not been confined to this area and requests have been made for permits to handle them in the drainages of the Sacramento and San Joaquin rivers. It has been considered one of the responsibilities of the Department of Agriculture to safeguard agriculture against menacing floods. Information available indicates that if these animals are allowed to establish themselves without hindrance or regulation, they will migrate readily to new sections. Reports come from Imperial Valley to the effect that muskrats have come into this area naturally from the Colorado River drainage, to cause thousands of dollars of annual expense in control as well as losses due to loosing irrigation waters from canals into fields when undesirable.

RODENTICIDE STUDIES

In cooperation with the United States Biological Survey, special attention has been given to the matter of increasing efficiency of methods now available for rodent control operations or for developing new methods. The United States Biological Survey has devoted the full time of one investigator to this subject, who cooperates with the department and county horticultural commissioners. From the results already obtained, it seems reasonable that after a few more seasons of consecutive investigation appreciable savings can be made in control materials by utilizing them when there is a certainty they will prove most successful as a means of combat.

It has been developed that thallium sulphate is a very satisfactory poison to supplement strychnine during seasons when this material is of reduced value due to climatic and feed conditions. By utilizing thallium sulphate, instead of the more costly gas methods, on grains, naturally hull-less, potted or otherwise treated, even during the green-feed period, hopeful results can be obtained. It has been concluded that further surveys are desirable to determine the most effective poisons in the several regions under varying climatic conditions.

There is still contention as to the value of phosphorus compounds for rodent poisons. This department has been consistently on record against the use of phosphorus generally because of the fire hazard involved and because of lack of information by users of the methods of preparation necessary for safety. The hazard involved in poisoning other birds and animals with phosphorus is being given consideration along with other poisons.

Ground squirrels have been taken at different seasons to determine with a measure of definiteness what goes on beneath ground when squirrels do not appear abundant on the surface, but when evident that the squirrel population for the area is still in existence. Hibernation and aestivation are two vexing problems and must be solved in connection with control measures if the full seasonal value of methods against these rodents is to be obtained.

PLAGUE INFECTION

There has been a more extensive finding of bubonic plague infection among ground squirrels than represents a healthy condition so far as menace to humans is concerned. Since the State Board of Health is in position to intensify field operations in hunting out and isolating foci of plague infection, better results can be obtained in suppressing this disease among rodents than through concerted campaigns of county horticultural commissioners and this department. Civic and developmental organizations have taken an interest in this matter and in cooperation with the Director of Agriculture have obtained the consideration of the Governor and the Department of Finance in making available a special fund with which to cooperate with counties and landowners in removing this plague menace from the state in so far as field rodents are concerned. The public health agencies need also to develop a program for combating plague infection in populous centers where infection may exist among rats.

The general plan for stemming the spread of bubonic plague infection among field rodents is briefly as follows:

The state will conduct two phases of the work: (a) the State Board of Health will continue intensive hunting to determine the presence of bubonic plague infection in field rodents; (b) the State Department of Agriculture with special funds will cooperate with county boards of supervisors, through their county horticultural commissioners, and with landowners; the state and county will furnish materials, and supervision of control operations, and the landowner will furnish labor. Such an agreement will give effective results if consistently prosecuted over a period of years by utilization of the best-known methods of suppressing ground squirrels.

GENERAL

Rabbits, pocket gophers, rats and mice have come to attention whenever losses have been reported and whenever field demonstrations or cooperative drives against any of these rodents have been requested. The service rendered has been helpful in relieving damage, although under no circumstances have any eradication projects been attempted.

The attention of all cooperating agencies interested in rodent control as a health menace has been directed to the possibility of transmission of tularemia, a disease known for some time but yet rather obscure as to general information of its characteristics.

A summary of the operations against rodents in California reveals that during the year approximately 7,673,964 acres of private lands were treated, to which can be added 43,526 acres of government lands and 21,640 acres of state lands, giving a total of 7,739,070 acres treated. The materials used in connection with this work amounted to 1,470,258 pounds of strychnine-coated barley and 602,728 pounds of grain treated with thallium sulphate, giving a total of 2,072,986 pounds, or approximately 1036 tons. Besides these grain materials, it is recorded that cooperators used as much as 39,000 pounds of phosphorus-treated grain. Gassing methods came in for the following amounts: 10,659 pounds of calcium cyanide and 640,850 pounds or 320 tons of carbon bisulphide.

The total amount expended by the counties through horticultural commissioners for service in rodent control amounts to $182,670.38, this figure not including any sums represented in purchase of poisons used or labor needed in treating infested areas.

The increase in rodent control work necessitated the addition of a field assistant, whose services were made available in November. Involving administrative, supervisory, cooperative and public relations work, it is evident that this force is inadequate to properly cooperate and follow up the many phases of rodent control. The organizations in some counties to cope efficiently with rodent control under the direction of the county horticultural commissioner have expanded materially. A ten-year program under consideration by Congress for the United States Biological Survey to systematically deal with problems in their special field will do much to increase the valued assistance and cooperation from that federal agency.

WEED CONTROL*

Of necessity, weed investigations are not among the functions of a regulatory institution; hence, attention has been paid to this phase of weed control only when evident that none of the agencies logically responsible was able to carry necessary researches. It is regrettable that the federal government, which carries on effective research and investigational work with other agricultural pests, has slighted proper studies on weeds and weed control. We have looked to them for the development of information on general weed control practices. The State Experiment Station has not developed a program in this field. This is no criticism of these agencies, but is due to a lack of demand on the part of growers, agricultural or civic organizations. Those interested in agriculture could concertedly bring this situation to the attention of the proper administrators and thereby help make the regulatory phases of greater value.

GOAT GRASS

With the finding of goat grass (*Aegilops triuncialis*) in some of the central foothill counties along the Sierras, it has become necessary for the State Department of Agriculture to determine what methods could be successfully used in combating this grass should the survey work and study by range and forage experts determine the desirability of intensive control.

This weed was reported indirectly to the State Department of Agriculture from Salt Springs Valley in Calaveras County in 1927. The information was to the effect that probably it covered only a few hundred acres in that county, but surveys by county, state and federal men revealed it to be more widespread, and when interested agencies were further contacted it was determined that this weed had existed in California since 1917 at least, though apparently its potentialities as a weed pest were not fully recognized. The survey revealed five counties infested: Calaveras, Stanislaus, San Joaquin, Sacramento and El Dorado, with another species of the same type, *Aegilops ovata*, found in Mendocino County.

* By C. Olsen, Superintendent, Rodent and Weed Control, Sacramento.

The greatest apparent menace from this plant is its ability to crowd out other forage plants of value for grazing. According to Cronemiller of the United States Forest Service, undoubtedly it can be responsible for the loss of from 60 to 70 per cent of valued range forage if allowed to persist. Live stock very definitely avoid it in the presence of even scanty feed of other kinds.

The horticultural commissioner of San Joaquin County engaged his entire staff in handpicking 10,000 acres where scattered infestations of goat grass were found. With this attempt to curb a potential weed menace, it seems just to give consideration to control on areas from which it might again spread into this district. To this end, the department carried on investigation with sprays, finding that Diesel oil at 100 pounds pressure gave good results. The horticultural commissioner of Stanislaus County subjected some 30,000 acres to a burning process, with fair results.

Stock driveways, over which stock must pass during the fall months after having come from the mountains, obviously must be cleaned if protection is to be afforded to other range areas in the foothill belt.

PUNCTURE VINE

The control of puncture vine continues to be the most important weed control project in California. Successful control measures have been quite well established, although several changes to improve equipment, such as portable burners, air compression spray rigs and liquid dusters, are being worked out. According to reports, there are now available 397 hand spray outfits and 73 power spray rigs assigned to puncture vine control exclusively and operated under the direction of or through the offices of the county horticultural commissioners.

The total expended by the counties in the control of this weed is $163,402.02, not including equipment costs. If these were added the total would reach approximately $250,000.

Two counties in the state have made application for proclaiming weed-free areas, these to be contingent upon an early survey during 1929. The increase in actual acreage of puncture vine infestation in the state has been material, but practically all in Tulare and Kern counties. Completed surveys by horticultural commissioners throughout the state indicate that there has been an average reduction in infestation, aside from the two counties mentioned, indicative of the success of the intensive work being followed out.

The value of assistance from cooperating agencies in the puncture vine fight can not be overestimated and in no phase of pest control is the necessity for a sound and favorable public sentiment so well demonstrated. The rejection of a number of carloads and truck loads of infested hay by the Los Angeles County horticultural commissioner has had a strengthening effect in puncture vine control in counties distributing hay into the Los Angeles market. Melons, grains and cottonseed have also suffered rejection on account of infestation by puncture vine seeds and burs on the part of counties which have made expenditures to bring this weed under control or in counties where the weed is practically nonexistent.

NURSERY SERVICE *

CHANGES IN REGULATIONS

Excepting for the revision of the ruling dealing with the prevention of spread of narcissus bulb pests, there were no changes in the regulations affecting the movement of nursery stock in California during the season just closed.

The preceding season emphasized some of the difficulties involved in having the state regulations materially different from those of the federal administration, and consequently a change to make the state requirements similar to the federal seemed advisable. This change may delay the clean-up program in California narcissus plantings. However, with the more rigid state requirements there was a heavy movement of local grown bulbs out of the state and an influx of bulbs from other states under the less rigid federal requirements, thus tending to delay the progress of the clean-up program. Consequently, with the approval of California narcissus growers, Pest Control Ruling "B" was revised to embody requirements comparable with the federal and was reissued under date of June 1, 1928.

Later approval of the treatment of bulbs infested with bulb fly larvae by means of fumigation at atmospheric pressure with calcium cyanide, and the adoption of this form of treatment by both federal and state departments, did much to simplify the problem of the grower having infested plantings.

NURSERY INSPECTION

While the inspection of nurseries and of nursery stock at point of origin has not been strongly emphasized because of the system of inspection of stock at point of destination, this phase of the work is receiving greater recognition and in several of the counties the horticultural commissioner has carried out a systematic general nursery inspection of all nurseries.

Increasing importance is being attached to this work, and in Los Angeles County several inspectors have been assigned permanently to nursery inspection work alone.

Nursery inspection has not been carried out except for special pests and if activity is to be called for on a general state-wide basis on all major pests it is probable that special legislation or other official action would be necessary to support such a program.

Under Pest Control Rulings "A" and "B," state-wide inspections have been made for citrophilus mealybug and narcissus bulb pests. That the progress of pest control in nurseries is accelerated by such inspection work, particularly when destination inspection is also operative, has been clearly demonstrated.

Similar to the arrangement of previous seasons, horticultural commissioners have served as collaborators with the Federal Plant Quarantine and Control Administration, thus with officials of the department, providing approximately twenty collaborators qualified to handle narcissus inspection and certification for movement of bulbs interstate.

* By Everett L. Smith, Superintendent Nursery Service, Sacramento.

DISEASE AND PEST CONTROL

With cooperative assistance and regulatory supervision by state and county inspectors, pest control in nurseries has progressed during the past year to the extent of eradication of certain pests, particularly mealybug and scale insects, in some nurseries. Pest control procedure applying especially to nurseries and including a definite plan of operation has been recommended for the control and eradication of some of the more important pests and has been put into use with good results in those nurseries where the plan was followed. In most other nurseries an effective control has been maintained and in general the condition of nurseries with respect to these pests shows improvement over the preceding year.

Coincident with the progress made against mealybugs and scale insects, there has been an improvement in the Argentine ant control work in many nurseries to a point where the problem is largely to eliminate the straggling ants which come over into the nursery from adjoining property.

Dictyospermum scale has been eradicated from a few additional nurseries during the past season, although a more comprehensive survey for this pest has added several nurseries to the list of those known to be infested. Nursery and greenhouse men having infested stock have been called upon to exercise diligent control measures to the end that eradication might be accomplished wherever possible. Repeated inspections have been made as an aid in the clean-up work, and the effective control which has been maintained in most of those nurseries affected should be of value in reducing the possibility of the pest becoming established in outside plantings. All infestations found in California to date have been under the shelter of lath or glass and there have been no authentic reports of this pest having been found on any stock grown in the open. The list of host plants is materially smaller than in sections where the pest has become firmly established.

A special survey in the Berkeley-Oakland area, where scattered infestations of European earwig are found, failed to reveal any infestation in nurseries, though a few specimens were found near the property line of one nursery. An infestation of earwig not previously reported covering at least two city blocks was located in San Francisco.

Black vine weevil has been found in additional nurseries during the past season and an effective control has been brought about wherever poisoned bait has been applied at the proper time.

The continuance of inspection of narcissus bulb plantings has brought about an improvement which, while not as rapid as was first anticipated, presents a favorable outlook for the state as a whole. The majority of the plantings were in a position to be certified as free from nematode, but the finding of infestation in some of the plantings where the stock had previously been treated led to the issuance of special instructions calling for more thorough and careful handling in the field and during treatment, to prevent reinfestation. Cultivation equipment was found in some cases to be responsible for spreading the pest. An infestation of bulb nematode was found in bulbs of *Leucojum vernum* planted on ground where infested narcissus bulbs had been grown previously, and the observation of the lesions or "spikkels" on

the leaves similar to those on narcissus was an incident developed by field inspection.

A state-wide test of hot water dipping vats was made, including one new piece of equipment put into use for the first time this season. Test trials were made of all fumigation chambers which came into use following the approval of calcium cyanide fumigation of narcissus bulbs to eliminate bulb flies. This treatment has done much to simplify the bulb fly problem and has proven to be very satisfactory, as indicated by results obtained during the initial season of its application. No infestation of greater bulb fly has been reported in narcissus bulbs of the counties of the southern portion of the state during the past two years, the last report being made in 1926.

Early in 1928 a block of apple stock was found affected with apple blotch, a disease of apples of the Middle West and East. The disease apparently was introduced on seedling apple stock shipped in from a nursery in one of the central states, and to prevent possible spread in California the stock was destroyed except for a small properly restricted block for temporary observation. In December this block was destroyed.

The finding of a new disease, a Coryneum blight of cypress, on mature cypress trees in several parts of the state and the report of this condition to the department, led to an inspection of nurseries, particularly in the affected areas. While the survey has not been completed, an inspection has been made in 39 nurseries and infected stock found in eight nurseries in the San Francisco Bay region, where the disease is most prevalent.

Wherever found in the nursery, it was recommended that infected stock be destroyed by burning. This program was readily acceded to by the nurserymen concerned and a recheck which has been made indicates that the work has been well done. However, further new infection of cypress nursery stock may be expected in those localities where the disease has become established on mature cypress trees.

INSPECTION OF NURSERY STOCK AT DESTINATION

The provisions of the state law referring to the inspection of nursery stock moving intrastate place such work largely on a basis of destination control and inspection. An extremely wide variety of plant material is inspected during the course of each year, making it advisable to group the shipments into general classes of stock for purposes of this report.

The following information assembled from reports of county horticultural commissioners covers the stock moving intrastate between the principal counties for the fiscal year ending June 30, 1928:

	Number of pieces N. S. inspected	*Number rejected*	*Number treated and passed*
Fruit stocks	14,948,343	463,229	15,421
Fruit cuttings, etc	4,266,834	----	----
Seed bed stock and seedlings	4,969,257	8,009	2,850
Ornamentals	4,777,857	57,144	----
Bulbs	6,907,139	31,691	----

County horticultural inspectors are available for the prompt inspection of plant material arriving at destination in all horticultural and

agricultural sections of the state, and in view of the large quantity of stock inspected little difficulty has arisen from the inspection and handling of shipments. Particularly has this been true during the last year.

NURSERY DIRECTORY

The "Directory of California Nurserymen" was issued as Special Publication No. 87, listing 1855 nurseries and nurserymen registered for the fiscal year ended June 30, 1928.

The general classes of stock represented with acreage were as follows:

Deciduous	745 acres
Citrus	361 acres
Ornamental	1,971 acres
Bulbs	739 acres
Miscellaneous	942 acres

The figures above indicate the trend of the movement of stock and the growing importance of the production and use of ornamental stocks and bulbs.

PREDATORY ANIMAL CONTROL*

Predatory animal control work, in cooperation with biological survey, counties, stock associations and individuals, was even more intensive during 1928 than in former years. Losses among live stock, poultry and game have materially decreased during the year in those counties where the control work was carried on. On the other hand, the sheep population has continued to increase in greater proportion than the decrease of predatory animals, because of confidence that there will continue to be less loss as time goes on.

The effects upon the sheep business of systematic predatory animal control are very apparent throughout the territory where conducted, both in increased numbers and quality of this class of stock. The latter point is of importance. While the sheepmen were subjected to constant heavy inroads on their flocks by predatory animals they did not feel justified in paying the higher prices demanded for a better grade of breeding stock. This producing of an inferior product naturally cut down their revenues. However, with a marked decrease in percentage of loss, in some cases as high as 95 per cent, they began to improve grades, with greater revenues accruing and a corresponding increase in industry stability.

Three new counties, Stanislaus, Merced and Tuolumne, took up the work; Yolo and Glenn discontinued cooperative relations, and in the case of these, wool growers' associations immediately took up the burden, with the state and federal governments as a unit cooperating equally. Hunters have been permanently located in specified areas for the protection of certain species of game, such as antelope and mule deer, both of which suffer materially from coyote and bobcat depredations. There is a very appreciable improvement noticeable, since antelope especially are increasing fast. Sage and blue grouse also have increased in those two counties, due to predatory animal control.

Only one case of rabies among coyotes was reported during the year, from Inyo County, but upon investigation this proved to have no

* Joint report by Charles G. Poole, state leader, United States Biological Survey, and W. C. Jacobsen, Department of Agriculture.

foundation. The predatory animal control forces are at all times alert to suppress both this disease and tularemia among coyotes and bobcats. Each year shows a decrease in outbreaks of rabies, due to the control of coyotes in the state.

The following counties and other agencies were in active cooperation with this bureau and the biological survey during the year:

Alameda	$2,500 00	Merced	$1,000 00
Amador	1,000 00	Modoc	1,538 26
Butte	2,500 00	Monterey	1,500 00
Calaveras	1,750 00	Napa	2,500 00
Contra Costa	2,200 00	Sacramento	700 00
El Dorado	1,500 00	San Joaquin	1,500 00
Glenn County wool growers	1,000 00	San Mateo	1,500 00
Humboldt	5,000 00	Solano	1,397 24
Kern	2,625 00	Sonoma	2,000 00
Lake	2,000 00	Stanislaus	1,000 00
Lassen	1,500 00	Tuolumne	1,000 00
Madera	1,000 00	Yolo County wool growers	1,215 00
Marin	750 00	Yuba	1,000 00
Mendocino	7,500 00		

The plan of unifying the control work was further advanced during the year, and it is planned to carry this out as nearly 100 per cent as possible during the ensuing year. This makes for greater efficiency and economy, with more lasting results. Also, the policy has been and will continue, as fast as possible, to concentrate upon the higher border counties containing breeding grounds, which furnish the coyote supply for the valleys. This system strikes at the fountain head of the infestation, tending to eliminate the cause before a general spread.

Many cases of losses among sheep presumably from predatory animals, upon investigation proved to be the work of dogs, which at this time are in many sections a far greater menace than are coyotes.

Officially recorded were 1156 bobcats, 3008 coyotes, 309 pups and kittens and 153 miscellaneous animals, and it is within reason to estimate at least three times this number as actually killed, because where poison is used many coyotes are disposed of that are never found by the hunters. On an average 56 hunters were employed throughout the year, representing a total of 18,519 man days, while the total cost of operations for federal, state, counties and other cooperative agencies was $83,452.93.

It is estimated that between $1,000,000 and $3,000,000 were saved to the stockmen and farmers alone, and it is impossible to state the intrinsic value of the game animals and birds preserved because of this protection, but undoubtedly it is of considerable magnitude.

Figuring upon the basis of the estimated number of sheep in the state and their present valuation, the cost per sheep for predatory animal control is about .002. If these costs were prorated among poultry, hogs, game, etc., which are equally affected by the work, this figure would be much reduced, and the cost to all would be so small as to be practically negligible and materially out of proportion to the net economic gains.

APIARY INSPECTION *

INTRODUCTION

The first year's administration of the California Apiary Inspection Act by the State Department of Agriculture and the county horticultural commissioners has been marked by a comprehensive registration, the establishment of an apiary certification service and decided progress in the elimination of American foulbrood from California.

The activities of the apiary inspection service divide themselves into three lines, which will be considered in detail as follows:

REGISTRATION

Apiary registration is written into the Apiary Inspection Act as an instrument to assist in locating apiaries and incidentally to determine the size and importance of the industry and assist in its better organization.

The results of registration may be tabulated as follows:

General Summary of 1928 Apiary Registrations

Nectar areas	Beekeepers	Colonies	Number of counties making no particular efforts toward registration
1. South coast and chaparral belt (Sage, So. California citrus, lima beans.)	3,876	174,528	0
2. Intermountain belt (Alfalfa, orange, No. and Cent. California.) (Star thistle, manzanita, creeping sage.)	5,303	127,057	6
3. Transmountain belt (Great Basin, Owens and Imperial valleys.) (Alfalfa, clover, cotton, melon.)	505	26,630	4
4. Bay region and cut-over redwood area of Coast Range (Deciduous fruit, alfalfa, clover, fireweed, Christmas berry.)	802	9,155	7
Total registered	10,486	337,370	17

These registrations have been made by newspaper publicity, letter and personal call. The principal beekeepers in the county respond to any one of these methods, but the most effective method, as well as most costly, has been the personal call. However, the value received has justified its cost.

The most complete registrations, those approaching 100 per cent, have been taken in those counties conducting area eradication programs. Aside from these, the counties where registration has been in progress during the past several years produced the most satisfactory registration. This fact forecasts a bright future for this part of the work. In most of the counties where registration has lagged, beekeeping is not an important industry.

Forced registration has been necessary in a few cases where refusal to register was met. In these cases, after a personal interview, a registered letter from the commissioner requested that registration be made within ten days, and when this failed the case was thrown into court, where it received favorable attention. A fine of $25 was given and sentence was suspended pending compliance with the law requiring

* By Frank E. Todd, Entomologist, Sacramento, California.

registration. In each case this was successful and due publicity augmented registration in general.

Production records provided for on the registration blanks proved a new feature to California beekeepers and production figures were given covering 60.5 per cent of registered colonies. The purpose of this requirement is to make a permanent and continuous record of



FIG. 127. Map showing areas covered by American foulbrood eradication programs.

apiary production. These figures help in properly presenting the value of the industry to the board of supervisors when seeking funds for its protection.

APIARY CERTIFICATION SERVICE

Profitable California beekeeping requires a considerable amount of migration because of the relatively short nectar flows and the localized

nature of the honey plants. This presents a real problem to the agencies charged with protective work, for migration is recognized as the most effective spreader of disease, both within the apiary itself and to the other apiaries.

The situation demands that migrating apiaries be free from disease, and certification is the logical answer to such a situation. However, the nature of foulbrood is such that an inspection at any given time is no guaranty to the condition of the apiary a few months later except in disease-free areas. The problem, therefore, requires a system of certification that will guarantee the reliability of cerificates of inspection.

The demand for reliable certificates of inspection requires the establishment of a uniform procedure for determining the condition of an apiary as a basis for acceptable certificates that could be accepted at face value in all sections of the state. Precedent in this matter is lacking, as most states have a provision which excludes bees on drawn combs. This regulation serves largely to prevent migration and inhibits the normal expansion and commercial interests of the industry. The real issue in apiary inspection service is not the inhibition of the industry but protection of the bees from the spread of disease.

A California apiary inspection certificate now means:

(a) That each and every colony in the apiary covered by the certificate has been thoroughly examined for disease just prior to its issuance.

(b) That no disease was found to exist in the apiary. (If disease is found inspection certificates are withheld until the disease is eradicated. This can be done at once by burning all diseased colonies under the supervision of the inspector. Reinspection within sixty days is required if control measures are used and no certificate is issued until eradication has been accomplished.)

(c) A true disease history as determined by former inspections is stated on the face of the certificate.

This type of certification is an experiment, but observations to date show that it holds promise of success in preventing spread of American foulbrood. The success of any system of certification depends primarily upon the integrity of the inspector who is responsible for its issue. We are satisfied that American foulbrood can not be "shaken" with any guarantee of the results. On the other hand, if careful inspection is given and all American foulbrood carefully burned under supervision of the inspector, the chances are good that a clean-up will be effected unless robbing has previously taken place.

Systematic inspection has covered thousands of colonies and has given opportunity to observe results in a large number of cases. The most detailed records are from Contra Costa County, where the percentage of apiaries showing disease dropped from 42 per cent to 16 per cent following a single inspection and burning. Previous shaking and robbing accounted for a large percentage of the latter figure. Stated in another way, 62 per cent of the diseased apiaries so treated were free from American foulbrood and 9.5 per cent of the remainder showed less than 1 per cent, while 21.5 per cent showed more than 1 per cent, while at the same time the per cent of disease in all colonies in Contra Costa County dropped from 12 per cent to 1.79 per cent.

The Result of Burning American Foulbrood

	Number of apiaries						Total number of apiaries studied
	Number of apiaries clean	Less than 1%	1% to 2%	2% to 5%	5% to 10%	Above 10%	
First inspection (all diseased colonies burned)	0	1	11	7	3	20	42
Second inspection	26	4	3	2	3	*4	42

* This is accounted for by robbing before the first inspection, shaking before the first inspection and a case of either a severe exposure of diseased honey or "salting" in an outfit which moved in from another county.

It is interesting to note that much of the recurrence of disease in cases investigated to date can be traced to "shaking," for, regardless of how carefully it is done, slips invariably happen and practically no cases of complete clean-up by this method are on record.

A summary of apiary migration is as follows:

Migration of California Apiaries– January 1, 1928 to January 1, 1929

County	Interstate				Intercounty				Intracounty	
	Into California		Out of California		Into county		Out of county			
	Apiaries	Colonies	Apiaries	Colonies	Apiaries	Colonies	Apiaries	Colonies	Apiaries	Colonies
Alameda			1	17	4	316	13	758	5	19
Colusa					14	901			42	1,365
Contra Costa					16	1,835	21	1,507	33	1,260
Fresno					11	833	73	6,920	61	3,610
Glenn					9	524	20	1,989	26	471
Humboldt									1	20
Imperial					20	1,880	4	400	8	501
Inyo						1,420		1,420		265
Kern						4,481		4,760	46	1,591
Kings					7	601	47	5,557		
Los Angeles	4	850	12	2,720	88	7,952	122	12,594	248	24,299
Madera					3	60	7	625	2	67
Marin					1	125	1	60		
Merced					7	883				
Modoc					3	300			3	250
Monterey					4	1,020	2	500	5	136
Riverside	16	1,630	15	2,750	48	3,505	19	3,676	64	6,460
Sacramento					11	227	16	621	22	543
San Bernardino			24	6,655	41	4,421	36	3,802	139	15,807
San Benito					2	350	2	350		
San Diego					17	881	24	1,629	27	572
San Joaquin			1	30	2	37	30	88	113	5,034
San Luis Obispo					4	256				
San Mateo							1	9	1	17
Santa Barbara									5	560
Siskiyou	1	90	1	4	1	80				
Solano					18	1,090	21	1,170	38	1,275
Sonoma					4	206	6	336	6	156
Sutter					9	1,020	7	430		
Stanislaus					3	280	10	1,080	11	971
Shasta					5	420	8	820		
Tulare	27	1,748	16	2,025	343	9,217	77	9,318	9	160
Tuolumne					1	4	1	4		
Ventura					17	2,669	11	1,598	25	3,311
Yolo					8	680	3	450	30	1,600
Yuba					1		2	28		
Totals	48	4,318	70	14,201	722	48,468	593	62,499	970	70,314

AMERICAN FOULBROOD ERADICATION

The only method that has successfully eradicated American foulbrood from any given area is the area eradication campaign. This requires:

(a) That each and every hive in the area (usually a county) be thoroughly inspected.

(b) That every American foulbrood colony thus located be burned under the supervision of the inspection staff.

(c) That this procedure be repeated until eradication is effected. (Experience in many places shows that two years in most cases will suffice and disease usually is reduced to between 1 and 2 per cent by the first stage of the campaign.) Four California counties put on such campaigns during the past year.

The progress of American foulbrood clean-up may be summarized by counties as follows:

SUMMARY OF DISEASE ERADICATION WORK, AND ITS COST

Type of work	*Number of counties*	*Average cost of colony inspected*
Area eradication (including clean-up)	4	$ .15*
Inspection and clean-up (not on the area plan)	21	.22
Hit-or-miss inspection	10	.26
Certification only	4	--
No disease eradication work	11	--

* Volunteer help was given by beekeepers in much of this work.

In this regard the detailed studies of area eradication work in Contra Costa County are interesting. This was done with a spring and fall inspection the same year and the details are presented in the following table:

Results of Burning All Disease Found on First Inspection

Number of apiaries studied	Number of colonies	First inspection	Second inspection after three to five months		
		Percentage of disease	Number of apiaries, no disease	Number of apiaries, 1% or less	Number of apiaries, over 1%
58	1,388	0 0	58	0	0
12	1,418	.77 to 2 0	7	4	1
7	826	2.0 to 5 0	4	3	0
7	427	5 0 to 16 0	4	2	1
16	551	16 0 to 100 0	11	0	5
Totals— 100	4,610	.....	84	9	7

The complete returns show that the disease was reduced from 12 per cent on the first inspection to 1.7 per cent of all colonies in the county on the second inspection. Most of the disease found on the second inspection was in four apiaries. In two of these shaking was done; in one other a diseased colony was robbed out just prior to the first inspection, and in the fourth case the apiary came from another county where there was some evidence that severe exposure or "salting" had taken place prior to the migration.

These results have been highly encouraging and resident beekeepers are proceeding with renewed confidence. A like situation exists in all counties which have adopted area eradication programs, and it appears

1928 Summary of Apiary Inspection Work in California

County	Registered		Apiaries			Colonies			Disposition		Legal	
	Beekeepers	Colonies	Inspected	American foulbrood		Inspected	American foulbrood		American foulbrood		Permits issued	Certificates issued
				Found	Per cent		Found	Per cent	Colonies burned	Colonies treated		
Alameda	46	1,015	31	11	32 2	1,439	99	6 9	99	0	9	28
Alpine												
Amador	3	48	3	0	0	48	0	0	0	0	0	1
Butte	192	8,449	*311	123	39 6	13,943	443	3 2	413	30	1	0
Calaveras	35	224	1	0	0	2	0	0	0	0	0	1
Colusa	246	6,322	*276	161	58 3	5,971	1,104	18 5	664	440		
Contra Costa	113	3,321	*226	68	30 0	6,642	376	5 68	329	47	7	37
Del Norte	3	71	3	0	0	47	0	0	0	0	0	0
El Dorado	38	662	38	38	100 0	662	380	57 5	293	87	0	0
Fresno	637	16,875	605	189	31 5	16,885	581	3 45	425	151	0	6
Glenn	383	5,498	*626	95	15 2	10,521	749	5 35	565	185	1	28
Humboldt	228	1,531	51	16	31 4	606	69	11 4	11	25	2	0
Imperial	339	19,639	173	71	41 0	8,648	404	4 68	404	0	0	0
Inyo	76	3,640	76	60	79 0	3,840	175	4 56	115	57	2	2
Kern	397	11,142	*597	115	19 5	10,784	443	4 12	336	111	4	103
Kings	121	5,911	106	44	41 5	5,772	263	4 58	263		0	44
Lake	8	30										
Lassen	8	981	35	13	37 2	1,177	48	4 1	0	48	8	8
Los Angeles	723	38,389	*809	237	29 4	28,984	716	2 48	587	88	8	220
Madera	131	2,010	70	17	24 3	1,301	54	4 15	19	0	0	8
Marin	48	443									1	1
Mariposa												
Mendocino												
Merced	366	8,188	247	44	17 8	6,387	170	2 66	125	45	8	12
Modoc	30	1,114	3	1	33 3	94	3	3 2	0	0	0	0
Mono												
Monterey	106	4,546	105	8	7 6	3,379	29	0 86	122	7	2	15
Napa	84	1,217										
Nevada												
Orange	370	15,742	*432	124	28 7	13,256	591	4 45	511	70	0	0
Placer	47	311										
Plumas												
Riverside	341	22,585	187	35	18 7	12,471	341	2 23	67	274	29	53
Sacramento	150	5,864	99	37	37 3	2,356	228	9 65	142	86	1	68
San Benito	29	404	2	0	0	350	0					
San Bernardino	979	39,830	530	388	73 1	38,348	2,598	6 80	513	2,066	422	218
San Diego	977	30,279	*946	217	21 7	27,617	1,033	3 61	661	372	87	0
San Francisco	5	67	5	1	20 0	67	2	2 98	2	0		
San Joaquin	915	13,573	379	114	30 0	9,901	482	4 86	396	65		7

San Luis Obispo	105	3,438									8	1
San Mateo	16	123	16	0	0	123	0	0	0	0	2	16
Santa Barbara	83	4,846	64	25	39 1	3,162	295	9 3	170	100	4	4
Santa Clara												
Santa Cruz	43	362	16	4	25 0	150	5	3 33	5	0	0	0
Shasta	68	4,510	98	30	30 6	3,901	141	3 6	44	52		
Sierra												
Siskiyou	52	1,256	52			1,256	183	1 46	152	31	0	1
Solano	119	2,139	114	7	6 15	1,345	106	7 5	106	0	0	22
Sonoma	202	2,157	56	7	12 5	802	13	1 62	2	12	20	6
Stanislaus	337	8,200	*385	80	20 7	5,600	427	7 6	427	0	0	51
Sutter	516	4,846				5,585	1,071	18 0	481	590	10	7
Tehama	48	4,728										
Trinity												
Tulare	303	11,446	159	24	15 1	10,648	173	1 72	73	100	0	41
Tuolumne	41	387	38	2	5 3	339	8	2 36	8	0	0	0
Ventura	192	14,873	256	42	16 4	12,447	114	0 91	100	14	0	8
Yolo	133	3,511	133	20	15 0	3,511	137	3 9	106	31	16	10
Yuba	83	1,031	83	17	20 5	1,031	106	9 8	106	0	0	2
Totals	10,515	337,774	8,442	2,485	29 5	281,388	14,160	5 0	8,842	5,184	652	1,030

* Our records on second inspection are not complete. The per cent of diseased colonies for first inspections only is close to 6 15. This we believe is low for the state as a whole as indicated by counties where area eradication programs were followed. In these latter counties the average per cent was 11 6.

likely that at least six more will enter on such programs during the coming year.

In counties where less systematic campaigns have been undertaken special attention has been given to notoriously neglected apiaries. In this manner a considerable amount of clean-up has been done and the desire for a more systematic program is becoming increasingly evident. In systematic programs the first inspection is always the hardest to accomplish.

THE INSPECTION STAFF AND AVAILABLE MONEY

According to the provisions of the California Apiary Inspection Act, the county inspectors of apiaries are appointed by their county horticultural commissioners subject to the approval of the boards of supervisors. The supporting funds, therefore, must come from the various counties. There was available during the past year $38,000 and fifty county inspectors of apiaries were appointed, the majority of whom qualified through examinations given by the State Department of Agriculture. Permanent appointments are not permitted by the laws of the state without such qualifications except in charter counties, where the inspectors are qualified by their local civil service commissions or boards.

DISEASE DIAGNOSIS AND EDUCATIONAL WORK

Progress in disease eradication can be made only in proportion to the backing given the work by the industry itself, therefore, it is necessary to keep the industry informed concerning the general plan of the work and its progress.

In addition, it became apparent that much confusion in diagnosis was prevalent, resulting in improper treatment. To correct this situation, an article was written on bee diseases of California in which details concerning American foulbrood and methods of handling it were discussed, and which received great favor.

Through the courtesy of the animal pathological laboratory of the State Department of Agriculture a diagnosis of samples of disease received from within the state has been made. A total of 132 such samples has been diagnosed.

SUMMARY OF THE YEAR'S WORK

The accompanying table shows that a vast amount of inspection work has been done. The most interesting thing about this record is the fact that 29.5 per cent of the apiaries inspected were harboring American foulbrood. The protection of the remaining 70.5 per cent therefore, becomes the vital issue. The disease, while present in all counties, was not found as widespread within the apiaries as was originally expected. The effort to clean up which accompanied the inception of the new law apparently has had a beneficial effect.

The per cent of colonies infected was likewise lower than estimated; however, conclusions should not be too hastily drawn, for it should be noted that the average of the four counties where every colony in the county was inspected showed 11.6 per cent infection. We believe the representative index to the percentage of diseased bees lies somewhere between the 5 per cent demonstrated in this table and the 11.6 per cent found in the above-mentioned counties.

BUREAU OF FIELD CROPS

L. M. JEFFERS, Chief.

THE FIELD CROP products of California are of importance to the state, not only because of the financial returns, but also because of the relation of these crops to a properly balanced agriculture, both from the viewpoint of production and in relation to marketing facilities and financing.

An act of the 1921 legislature established official standardization and inspection of field crop products. While there has been some consideration of a compulsory inspection law such as prevails in a great many other states, to date the legal authority under which these activities are carried on is on a permissive basis. There is yet much to be desired relative to the standardization and inspection of field crop products in California. It is hoped that with improved cultural and handling methods there will be developed a more general appreciation of the advantages derived from the official application of proper standards in connection with the marketing of the field crop products.

The bureau has the responsibility of administering the following acts:

1. Field Crops Inspection Act of 1927.
2. Seed Law of 1921.
3. Warehouse Act of 1921.
4. Certified Cotton Seed Act of 1925.
5. Terminal Weighing Act of 1927.

Under the authority of the Field Crops Inspection Act there are established official California standards for the grading of all cereals, identical with those established under the provisions of the United States Grain Standards Act. The state department maintains grain inspection laboratories at Sacramento, San Francisco, Stockton and Vallejo. In addition to the services rendered by these offices, the Director of Agriculture has issued authority to the grain inspectors employed by the San Francisco Chamber of Commerce and the Los Angeles Grain Exchange whereby these commercial exchange inspectors are authorized to certificate as to the grade of grain in accordance with the official standards. These two exchanges have maintained inspection service for several years, the inauguration and maintenance of such a service being a definite recognition of the need of standards and inspection.

Standards for beans were officially established by the department and inspection service was available for a time. However, due to lack of interest and use on the part of growers and to opposition on the part of certain dealers, the department discontinued this service and there are no official state standards for the grading of beans.

At the present time there is no official state cotton classing service. For several seasons such a service was available to the growers, but it was discontinued, due to developments in the cotton industry relative to financing and marketing methods which tended to decrease the use of the service. While it is believed that an official cotton classing service is of valuable assistance to the growers, yet the maintenance of this type of service must be governed by the demand for the same and the use made of it by the growers.

The most important field crop commodity of the state is tame hay. The U. S. Department of Agriculture has established standards for the grading of alfalfa and is working toward grades for grain hay. Considerable work has been done along educational lines in California for the purpose of familiarizing growers, dealers and consumers with the standards and their application. It is hoped and expected that the next few months will bring about the development of alfalfa hay inspection so that such a service will be an important factor in the alfalfa industry.

The tabulated data given herein in connection with the special report on grain inspection indicate that there has been a decided increase in the volume of certificates issued by the department. The records of the inspection service indicate a wider and more extensive use of certificates in the marketing of grain and it is gratifying to note that there is developing a better understanding of the necessity for a definite basis in the marketing of grain.

The individual reports covering the seed inspection service and the supervision of bonded warehouses contained herein, indicate the extent and development of these two lines of activity.

Although the Certified Cotton Seed Act of 1925 was introduced and passed at the request of cotton growers, up to the present time they have not made use of the service. The distribution of cotton seed has been developed by independent organizations and to date they have not deemed it desirable to make use of official services in this activity.

The Terminal Weighing Act of 1927 gives to the Department of Agriculture authority to render official weighing service at terminals in connection with the handling of grains and grain products. There has been a limited call during the past year for this type of service. It is believed in the future there will be a more extensive recognition on the part of both growers and receivers of the advantages of a terminal weighing service by an official and disinterested agency.

GRAIN INSPECTION

The value of grain is determined by its quality. When it is sold on an "as is" basis there is no definite or common language for the indication of quality, therefore, contracts can not contain any clear-cut statement relative to basis of settlement or delivery. The use of average price in the merchandising of grain is detrimental, not only to the individual grower, but also to the industry as a whole. On the other hand, when grain is sold and bought on the basis of grade there are definite terms, both for the contract and for settlement. This system gives a discount for poor grain and a premium for good grain.

Since the inauguration of the Official State Grain Inspection Service in September, 1921, there has been a consistent and satisfactory increase in the volume of inspection service rendered. There is still much opportunity for additional use of this service by the growers and dealers and such development will bring decided improvement in the merchandising of the grain produced and marketed in California. The following tables give information relative to the number of inspection certificates rendered by the State Grain Inspection Service:

TABLE 1. Total Grain Inspection Certificates Issued During 1925, 1926, 1927 and 1928.

Year	Corn	Wheat	Oats	Barley	Rice	Grain sorghums	Beans	Miscellaneous	Total
1925	411	605	3	19	1,565	80	2	1	2,686
1926	883	1,557	147	16	2,248	258	1	14	5,124
1927	785	2,799	77	218	3,815	565	11	9	8,279
1928	2,171	3,117	135	201	4,350	560	1	11	10,546

TABLE 2. Total Grain Inspection Certificates Issued Each Month for Each Office in 1927 and 1928.

Months	Sacramento		San Francisco		Stockton		Vallejo		Total	
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928
January	76	434	21	116	51	136	175	301	323	987
February	202	269	234	256	86	309	152	150	674	984
March	333	143	230	108	89	232	220	89	872	572
April	172	98	172	83	44	252	237	175	625	608
May	101	150	75	143	42	202	286	245	504	740
June	174	120	121	119	74	344	138	163	507	746
July	105	118	81	200	134	536	401	205	721	1,059
August	12	110	69	141	87	546	329	114	497	911
September	25	74	87	114	39	167	340	59	491	414
October	387	543	58	184	76	400	196	186	717	1,313
November	756	763	93	207	138	245	197	59	1,184	1,274
December	674	206	131	228	156	396	203	108	1,164	938
Totals	3,017	3,028	1,372	1,899	1,016	3,765	2,874	1,854	8,279	10,546

BONDED WAREHOUSES*

California licensed warehousemen, operating California bonded warehouses throughout the state, stored approximately fifty million dollars worth of agricultural products the past year. These warehousemen are custodians of this merchandise in the fullest meaning of the word and are much like bankers, except a bank is permitted by law to use a certain percentage of the depositors' money, while a warehouseman is not allowed this privilege. The banker and the warehouseman are alike in that they both agree to return to the depositor the commodity deposited. The warehouseman, assuming the risk for protection of the goods deposited with him, assumes the same risk as the banker. In many respects the business of warehousing is similar to banking, the one storing agricultural products or merchandise, the other storing money. In both instances the property stored is that of another, to be released, withdrawn, or delivered upon order from the owner.

A banker need not return the identical goods deposited. He is expected to return only the equivalent of the value deposited. A warehouseman must, upon demand, return the original goods deposited, except in the case of fungible goods that have been officially graded. He then is allowed to store like grades and deliver the proper quantity of the common store. He shall not mix or blend fungible agricultural products of different grades, unless authorized by the depositor.

The California Warehouse Act was passed primarily to assist the producer in providing a type of receipt that could be used in obtaining

* Report prepared by V. O. Wolcott, Supervising Warehouse Inspector.

large loans from the Federal Intermediate Credit Bank, but due to the close relations that have been established by other bankers handling the California bonded receipt, it is becoming not only a great help to the farmer in the proper financing and marketing of his product, but an important aid to the banker.

The State Banking Department maintains bank examiners to examine the banks of the state, while the State Department of Agriculture maintains at all times trained inspectors to closely supervise and check those warehouses issuing California bonded receipts, making at least four inspections or audits annually at irregular intervals. The importance of these inspections is apparent to anyone familiar with the handling of warehouse collateral. There are found many irregularities that may seem of minor importance to some but unless corrected these may prove disastrous not only to the warehouseman, but to the industry served. These conditions, when found in a California bonded warehouse, are immediately adjusted. Some of the most common practices (in most cases caused by carelessness with no intent of fraud) that do occur in some warehouses, but should not occur in any warehouse whether licensed or not, are: Substitution of products, removal of the commodity from one warehouse to another, issuance of receipt before the commodity is actually in the warehouse and delivering without the proper authority or surrender of the warehouse receipt.

When such organizations and cooperatives as the Sun-Maid Raisin Growers, the Rice Growers Association of California, the California Canning Peach Growers, the California Cooperative Producers, the California Prune and Apricot Growers Association, the Wyandotte Olive Growers Association, the Imperial Valley Grain Growers and the Seven Peach Growers avail themselves of this service and finance the marketing of their products in most instances exclusively by the use of California bonded warehouse receipts, it is quite apparent that the California Warehouse Act is fulfilling a very important need in the marketing of California agricultural products.

During the past year, as shown by table 3, there was a considerable increase in the licensing of warehouses under the California Warehouse Act.

TABLE 3. Number of California Bonded Warehouses Under License, by Months, for 1926, 1927 and 1928.

Month	1926	1927	1928
January	89	97	150
February	89	96	147
March	88	95	147
April	89	92	146
May	82	93	146
June	78	93	147
July	72	93	150
August	76	95	159
September	73	103	161
October	83	126	153
November	93	141	151
December	97	151	147

From table 3 it will be noted that there were four less warehouses licensed under the act at the end of 1928 than on the last day of 1927.

However, during 1928 there were 30 new warehouses licensed under the California Warehouse Act. For economic reasons and due to seasonal activities some warehouses were discontinued entirely.

TABLE 4. California Bonded Warehouses and Commodities Stored.

Commodity	January 1, 1928		December 31, 1928	
	Number of warehouses	Capacity	Number of warehouses	Capacity
Dried fruit	49	363,750 tons	40	341,150 tons
Grain	84	362,575 tons	84	345,405 tons
Canned goods	15	3,529,000 cases	19	4,871,000 cases
Olive oil	1	76,000 gals.	.....	.....
Nuts	2	590 tons	3	940 tons
Cotton	.....	.....	1	5,000 bales
Totals	151	.....	147	.....

At the close of the year there were 47 different warehouse companies or individuals licensed to conduct the 147 California bonded warehouses. The surety bonds filed with the department, to secure the faithful performance of obligations assumed by these warehousemen, totaled $790,800. While the actual number of warehouses under bond and license at the close of 1928 is four less than on December 31, 1927, the aggregate storage capacity is considerably greater. At the close of 1928 it is estimated, on a farm price basis, that the value of commodities for the space licensed equals $50,000,000, compared to an estimated value of $45,000,000 for December 31, 1927.

SEED INSPECTION

Services designed by legislation in the various states to give protection to the purchaser of agricultural seed, may be broadly grouped in two classes. The first type establishes minimum quality standards, by which all seed of lower quality is restricted from sale. The second is based on the assumption that every purchaser may select the seed adapted to his needs if all seed is correctly labeled, by having presented on the label the essential quality statements.

The California Seed Law, as now in force, is of the second type. Those familiar with it know that no kind of seed offered for sale in the state can, if correctly labeled, be kept off the market by state authority, no matter what the quality may be, unless prevented admittance in a particular county, by county quarantine measures. All lots of agricultural seeds offered or exposed for sale in this state, if merchandised legally, must bear labels carrying statements of the commonly accepted name, purity, weed seed content, germination, etc. Without consideration of the minor phases of seed quality or label requirements, it may be stated that there are four main factors of seed quality regarding which every planter is concerned when he buys planting seed, namely: Percentage of purity, the presence of weed seeds (especially noxious weed seeds), the percentage of the seed that is capable of germinating into vigorous seedlings and the inherent quality or varietal purity. The three important factors of mechanical purity, weed seed content and germination, can, by approved laboratory tests or analysis,

be determined by a trained seed analyst and are required to be placed on the label. The degree of varietal purity is, on the other hand, an intangible quality to determine and is as yet without a known measure by laboratory methods. Only by known breeding and production combined with careful handling can this factor in most seeds be determined prior to actual planting and growing of the crop. The other factors that can be determined are, however, the ones which the California Seed Law of 1921 is designed to cover.

This law has provided for a state seed laboratory and an inspection service and any person in the state may submit seed samples for test, as to purity analysis, germination, examination, or identification.

Such samples are handled without charge for a limited number of tests during each calendar year, but beyond this limit additional samples are handled on an established fee basis. The state seed laboratory never has been, and probably never will be, totally financially supported by the fee samples handled. To commercialize such an agency and make it self-supporting would probably defeat the most useful purpose for which it operates, which is to make available to the agriculture of the entire state reliable seed test results, at a minimum cost. During 1928 the fee samples handled yielded a revenue to the state of $1,783.55. In 1927 this revenue amounted to $1,732, while in 1926 the total was $2,000.90.

The samples received in the laboratory are divided into three groups, namely: Public service, fee samples and inspection and investigation. In accordance with the regulations in force any person or firm is allowed 10 individual tests free each year. An individual test is purity, germination, examination or identification. Any combinaton of these individual tests may be had for any sample, if desired, although the basis of record is as individual and not sample tests.

The seed laboratory is situated in the State Office Building, Department of Agriculture, at Sacramento, and is maintained cooperatively by the United States Department of Agriculture and the California department. Both federal and state interests are probably best served on this basis. The best information from the federal department is always available for consultation on seed analysis problems or technique of laboratory methods. All lots of seed entering the United States through the California ports are examined and passed upon by a federal analyst associated with the laboratory at Sacramento, who also supervises the staining of such lots of foreign produced seed entering the United States, as is required by the federal government.

During the year the laboratory was moved from the old quarters to the present location in the State Office Building. There was some loss of time and service during the transfer, all of which is well compensated for in the new location by better advantages for accurate and careful work. Also a sunlight germinator was added to the equipment which provides desirable opportunity for soil germination tests under controlled conditions.

Along with the service rendered to applicants who submit seed samples for test, the seed laboratory serves another essential purpose in testing all inspection samples taken by seed inspectors, to check information carried on seed labels on stocks that are being offered for sale to the public.

It has been generally recognized that the inspection work attempted in past years has not been sufficiently extensive to give proper protection to the seed purchaser, appropriations providing for one full time and one part time inspector only. In an agricultural state having the area of California, it is physically impossible for so few inspectors to observe any large part of the lots of seed being offered for sale, so before the close of the year this force was increased to two full time inspectors. Beneficial results are already apparent. This force should be brought to a minimum of four inspectors, however, in order to give the service to all parts of the state.

Seed inspection has been advanced materially by the aid given in many counties by the county horticultural commissioners, who can serve on a local basis in a distinctly beneficial way. These men, through cooperation, are in an improved position to enforce certain quarantine regulations, which also serves the seed purchaser of the county.

In carrying out the duties established by law, it is occasionally necessary to prosecute wilful violations of the seed act. It is encouraging to observe, however, that violations are not always intentional and most frequently are corrected by information as to the requirements of the law and the advantages to be gained by truthful labeling of seed before selling. Each year progress seems to have been made toward better and more complete labeling, although there is still much opportunity for improvement, especially among many handlers of cereal grain seed.

During the year, 1541 seed merchandising establishments were inspected by the state department. It is unfortunate that this number could not have been increased at least fourfold. There were 108 inspection samples taken for checking purposes. In 1928, 3470 samples were handled by the laboratory involving 1906 purity tests, 3094 for germination, and 156 tests for identification or examination.

Table 5 shows in tabular form the receipts by months and the type of tests required, as well as summaries for other years. In table 6 a percentage segregation of different crop types of seed received at the laboratory for each month during 1927 and 1928 and for each year is shown.

Late in 1928, through the joint efforts of those individuals or agencies interested in the California seed problem, there was organized the California Seed Council. The purposes of this organization are to bring about greater unity of purpose, policy and program among the various agencies, directly or indirectly interested in the farm seed problems of California.

Those groups represented in this council are: The Pure Seed Association of California, the Division of Agronomy of the College of Agriculture of the University of California, the Extension Service of the College of Agriculture of the University of California, the California Department of Agriculture, the Federal-State Seed Laboratory of California, the Commercial Seed Laboratories of California, the Horticultural Commissioners' Association and the California Membership of the Pacific Coast Seedsmen's Association and the California Hay, Grain and Feed Dealers Association.

This indicates a distinct step of progress for seed improvement in the state. The united efforts of the representatives of these groups doubtless can bring sound judgment and effectiveness to the improvement of many of the seed problems.

TABLE 5. (A) California Cooperative Seed Testing Laboratory Record of Samples Received and Tests Conducted by Months for 1928, and
(B) Samples Received and Tested during 1922 to 1928, Inclusive.

Periods	Total					Public service					Fee					Investigation and inspection				
	Total	Purity	Germination	Identification	Examination	Total	Purity	Germination	Identification	Examination	Total	Purity	Germination	Identification	Examination	Total	Purity	Germination	Identification	Examination
A																				
1928																				
January	299	168	268	3	9	182	109	157	2	6	78	26	72	1	3	39	33	39	0	0
February	318	185	295	4	25	245	119	160	2	22	85	40	79	0	3	28	26	26	2	0
March	392	247	392	4	17	235	145	201	3	17	156	91	100	1	0	1	1	1	0	0
April	272	145	255	11	1	204	60	186	11	1	58	45	57	0	0	10	10	10	0	0
May	186	54	170	4	5	63	19	51	3	5	44	22	40	1	0	79	13	79	0	0
June	177	46	152	12	2	74	29	52	11	2	99	13	96	1	0	4	4	4	0	0
July	94	40	79	8	2	46	16	34	8	2	47	23	44	0	0	1	1	1	0	0
August	288	173	267	3	4	127	81	116	3	3	152	83	142	0	1	9	9	9	0	0
September	345	197	319	4	3	167	104	150	4	3	172	87	164	0	0	6	6	5	0	0
October	408	316	408	3	1	191	155	171	3	0	268	152	258	0	1	9	9	9	0	0
November	354	220	328	2	14	140	81	121	2	13	209	134	202	0	1	5	5	5	0	0
December	341	221	339	3	12	132	87	110	3	12	207	132	197	0	0	2	2	2	0	0
B																				
Total samples rec'd. 1928	3,534	1,972	3,150	61	95	1,766	1,005	1,509	55	86	1,575	848	1,451	4	9	193	119	190	2	0
Forwarded, Jan. 1, 1928	37	35	37	0	0	3	3	3	0	0	2	0	2	0	0	32	32	32	0	0
Total to test in 1928	3,571	2,007	3,187	61	95	1,769	1,008	1,512	55	86	1,577	848	1,453	4	9	225	151	222	2	0
Forwarded, Jan. 1, 1929	101	101	93	0	0	34	34	29	0	0	65	65	62	0	0	2	2	2	0	0
Total tested in 1928	3,470	1,906	3,094	61	95	1,735	974	1,483	55	86	1,512	783	1,391	4	9	223	149	220	2	0
Total tested in 1927	4,460	2,282	3,901	49	224	1,745	1,125	1,517	38	47	1,653	792	1,466	10	131	1,072	315	1,068	1	46
Total tested in 1926	4,012	1,990	3,567	121	78	1,687	1,059	1,452	58	19	1,951	681	1,808	5	59	374	220	307	58	0
Total tested in 1925	3,503	1,772	3,080	202	32	1,868	1,086	1,686	22	19	1,336	617	1,272	8	13	299	69	122	172	0
Total tested in 1924	3,719	2,058	3,184	39	113	2,003	1,153	1,895	35	43	1,397	861	1,128	4	2	229	44	161	0	68
Total tested in 1923	3,788	2,025	3,419	38	13	2,752	1,256	2,516	37	13	851	585	626	1	0	185	184	177	0	0
Total tested in 1922	3,498	1,996	3,420	48	13	2,529	1,241	2,374	48	13	969	485	946	0	0	0	0	0	0	

TABLE 6. Receipts at Seed Laboratory by Months for 1927 and 1928, Expressed by Types as a Percentage of the Monthly Total.

	Alfalfa	Other forage	Cereals	Cover crops	Beans	Cotton	Lawn and meadow	Vegetable	Flower	Miscellaneous
1927—										
January	33 6	1 7	13 2	2 0	1 1	6	10 7	18 5	15 8	2 8
February	39 4	6 8	12 9	2 9	2 1	2 1	10.8	18 7	0 3	3 9
March	17 4	4 1	18 5	1 3	1 8	2 1	9 8	40.0	0 7	4 3
April	4 9	17 2	28 5	12 6	8 4	1 0	9 0	10 0	5 8	2 6
May	12 3	13 7	13 0	16 7	9 4	0 7	21 5	8 7	1 4	3 6
June	0 7	3 8	0 7	2 0	2 2	0 0	8 5	78 1	0 8	3 2
July	4 1	2 2	3 2	13 7	4 6	0 0	7 7	48 6	2 2	13 7
August	14 4	0 0	13 0	17 1	5 6	0 0	20 6	22 7	0 0	6 6
September	20 9	1 5	23 2	9 6	1 8	0 0	16 7	24 5	0 0	1 8
October	23 6	0 5	26 1	2 5	0 3	0 0	12 0	33 3	0 0	1 7
November	14 1	1 0	48 5	1 0	0 2	3 9	7 2	22 1	0 0	2 0
December	0 0	4 5	41.1	12 0	0.7	5 9	5 9	23 4	3 9	2 6
Total number of samples for year—by types	632	172	872	265	109	57	465	1,453	103	155
Per cent of yearly total—by types	14 8	4 0	20 4	6 2	2 5	1 3	10 9	33 9	2 4	3 6
1928—										
January	18 7	5 7	22 0	0 7	0 4	3 0	14 1	31 4	2 0	2 0
February	20 5	18 1	20 9	0 6	3 5	5 4	5 7	21 2	0 3	3 8
March	22 9	8 9	28 6	1 8	5 6	1 8	3 3	17 7	3 0	6 4
April	6 2	8 8	9 5	4 1	15 2	0 4	6 9	9 2	0 0	39 7
May	2 2	10 7	1 6	2 7	5 9	0 0	12 9	20 5	2 2	41 3
June	1 7	2 8	6 2	2 3	5 1	0 6	11 8	59 3	0 0	10 2
July	2 1	0 0	10 6	12 8	1 1	0 0	18 1	44 7	0 0	10 6
August	10 8	0 7	33 4	5 2	1 7	0 0	13 2	32 6	0 7	1 7
September	20 8	2 0	26 7	4 4	0 0	0 0	6 7	34 7	0 3	4 4
October	21 0	2 4	41 6	1 3	0 9	0 0	5 1	25 8	0 6	1 3
November	23 7	4 0	32 4	0 6	4 0	0 0	7 9	25 4	1 1	0 9
December	15 0	2 9	28 1	0 3	2 1	9 1	13 5	25 8	2 1	1 2
Total number of samples for year—by types	573	202	891	82	126	66	313	954	40	287
Per cent of yearly total—by types	16 2	5.7	25 2	2 3	3 6	1.9	8 9	27 0	1 1	8 1

BUREAU OF DAIRY CONTROL

C. U. Duckworth, Chief

THIS bureau is concerned with the maintenance of high standards of quality for dairy products, the protection of the dairy industry against abuses and fraudulent trade practices and the compilation of dairy statistics, and is directly responsible for the enforcement of the General Dairy Law of California, the Pure Milk Law, the Certified Milk Act, the Prepared Milk Act, the Pasteurized Dairy By-Product Act, and the Containers Labeling Act in so far as it is related to the dairy industry.

An outline of the various subdivisions of the bureau work follows:

1. Market Milk

Public appreciation of the market milk program is evidenced by the fact that ten new inspection departments have been granted approval for grading of market milk. Included in these ten organizations are two entire county units, the others consisting of single cities. Three more cities have been added to inspection departments that were organized prior to 1928, making a total of 60 cities and counties holding state approval for grading of market milk and bringing the state grade label of quality to over 275 cities and towns. These approved departments represent an approximate population of 4,356,818 persons consuming 331,411 gallons of milk daily, or a per capita consumption of 0.60 pint. The average quality of California's graded milk, which is over 90 per cent of the market milk sold in the state, computed on a volume basis for the year 1928, is 95.4 per cent.

The control of the market milk is carried on mainly by conducting milk scoring contests. Each contest requires at least three days to complete; the larger departments require more time. Only a part of this time is required in the actual scoring of the milk, the remainder being spent in inspection of laboratories and method of milk analysis and inspection of the plants and dairies.

As a record of the analysis of each sample of milk from each dairyman is kept by the local inspection department and is used at the time of the contest in computing the final score of each individual dairyman, the market milk specialist can, in a short time, have a comprehensive picture of the efficiency of the local inspection service; also as to which dairies are in the greatest need of inspection or in need of advice pertaining either to the dairy or to legal matters regarding actions taken against the dairy.

During the past year 114 contests and surveys were conducted. With the increased number of departments a greater portion of the market milk specialists' time was taken in scoring the milk, and it was felt that considerable advantage could be derived by the addition of another market milk specialist, making a total of three to carry on the work. This has resulted in an increased number of plant and dairy inspections being made.

The change in the policy of the bureau in regard to publicity given surprise milk scoring contests makes it optional with the local department in publishing name and group score of the dairymen. While the

published results of these contests draw attention of a sufficient number of consumers to cause a material loss in trade for those dairies at the bottom of the list and a corresponding gain for those at the top, most approved departments still feel that it is a means whereby the quality of milk will be improved, and the majority are continuing to publish the results of the contests.

2. Receiving Point Inspection Service

Milk and cream delivered at plants for manufacturing purposes are graded at the receiving platform on the basis of bacteriological and chemical tests of quality determinations at regular intervals, milk being graded by the modified direct microscopic count and cream by the modified volumetric acidity test, together with flavor and odor. Dairies delivering undergrade products, as determined by these tests, are visited and instructed in the manner of producing high quality products.

Special attention is given to the washing, sterilizing and handling of equipment, clean milking, cooling and protection from contamination. Milk or cream found to be unwholesome or unfit for human consumption within the meaning of the General Dairy Law of California, is colored and marked for identification and returned to the shipper.

Manufacturers in four sections of the state have entered into an agreement with the State Department of Agriculture for the establishing of a milk and cream grading project in each section. This work is voluntary and self-supporting. It insures the operators of high quality raw products, which are essential in the manufacture of high quality dairy products. The existence of these projects depends entirely upon the support received by the industry and the favorable grading results.

The production of first-grade milk and cream shows a substantial increase in 1928 over 1927, while the production of second and third-grade milk and cream shows a remarkable decrease.

3. Butter Control

The butter control program is based for the most part on the results of laboratory analysis of the product collected by each of the district inspectors. The butter manufactured by each plant in the state is collected in this way and analyzed chemically for fat, salt and moisture content.

Special effort is directed to the sources of undergrade butter, the adoption of remedial measures being required.

Supervision is also given to the labeling of butter in accordance with the legal provisions on the subject. The quality of California's butter supply has been materially improved through the cooperation received from manufacturers throughout the state in complying with the legal standards. The results of this work protect the public from the possibilities of obtaining adulterated or unwholesome butter, and protect the manufacturer from the competitor who would seek to profit through the sale of an undergrade product.

4. Cheese Control

Cheese control work includes inspection of factories; collection of samples for chemical analysis; examination of packages for labels;

standardization of quality and composition; and the issuance of special permits.

During the past year special attention was given to standardizing labels and composition of cheese with respect to moisture and fat content. Samples of each variety were collected and analyzed at regular intervals. Factories found to be manufacturing a product deficient in fat or containing excessive amounts of moisture were instructed to manufacture cheese to conform with the requirements of the General Dairy Laws of California.

Cheese of high quality and uniform composition stimulates production and consumption, both of which have shown remarkable increases during the past few years.

5. Ice Cream Control

As the year 1928 closes we find that the ice cream control program is progressing along well defined lines toward a definite goal. The recently enacted bacteria and food solids standards for ice cream have received the majority of the state ice cream specialists' attention.

Prior to 1928 the bureau's work on ice cream was confined almost entirely to the enforcement of the fat standard. This work was handled by the regular district inspectors in connection with their other routine inspection work. With the adoption of new standards for quality in ice cream came the necessity of specialized effort along these lines. During the past year (1928) this work has taken the form of service to the manufacturer rather than law enforcement or regulatory. It has been the policy of the bureau in this connection to work with the ice cream manufacturers wherever the product was found to be below standard, and show them how ice cream of a low bacterial content can be produced.

It has been the duty of the ice cream specialists to point out sources of bacterial contamination, to stress the importance of sterilization and suggest improved methods of processing and manufacturing. The cooperation which the ice cream plants have given the bureau in carrying out this program is commendable and proves that they are earnestly endeavoring to improve the supply of ice cream.

The following figures will illustrate what can be done in the way of controlling the bacteria count when quality materials are used and proper methods are employed:

	Plant 1	*Plant 2*
Bacteria count before inspector's visit	6,300,000	4,300,000
Bacteria count after inspector's recommendations had been followed	8,700	5,700

The first survey of the state showed that 55 per cent of the ice cream was above the legal bacteria standard while a second survey indicates that 64 per cent is within the bacteria requirements—an increase of 9 per cent. The ice cream control program has not shown the rapid or sensational quality improvement characteristic of the milk grading projects, due to the fact that there are so many complications entering into the final bacterial content of ice cream. In many cases it has been necessary to trace the milk, cream and other products directly to the producers in order to control high counts in the finished product.

High counts in ice cream have been traced to many causes. The most prevalent of these is attributed to inadequate or complete lack of sterilization of equipment.

Considerable time and effort have been spent on the newly adopted food solids standard. The food solids content of ice cream is calculated by multiplying the average weight per gallon by the percentage of total solids. The average weight of 30 cans is taken as the basis for computing the weight per gallon. In the event that fewer than 30 cans are available, an average of all full cans is taken.

The average weight of California ice cream is 4.66 pounds per gallon. The average food solids content per gallon is 1.76 while the law requires only 1.6. A recent survey showed that only 16 per cent of the ice cream fell below the required food solids content.

In addition to carrying out the regulatory work on ice cream, many trade problems such as density control, installing equipment properly, processing, freezing and calculation of formulas have been successfully worked out by the inspectors.

6. General Products Inspection Service

The following products fall within the scope of the general products inspection service: Evaporated and condensed milk, powdered milk, pure milk fat, buttermilk, cultured milk, acidophilus milk, modified milk and skim milk.

Quality standards are enforced with respect to each of these products and attention also is given to the sanitary conditions under which they are produced and manufactured.

The control of acidophilus milk has been retarded somewhat owing to the lack of authoritative information upon which to base specific quality standards.

7. Imitations Licensing Service

The number of dealers in imitation dairy products during the past year has increased quite considerably, particularly imitation ice cream and imitation ice milk.

As the importance of all dairy products as an indispensable food becomes more and more firmly fixed in the minds of the public, it becomes more attractive to those who would profit by placing an imitation on the market.

The principal imitation dairy product regulated by the bureau is oleomargarine. License is required of all manufacturers, wholesalers, retailers, bakers and restauranteurs handling the product. This requires the licensing of tens of thousands of such dealers in this state every year.

8. Commercial Testing Service

Milkfat, from milk and cream, is the wealth of the dairy industry concentrated into approximately one twenty-fifth of the volume of the original milk from which it was taken. The test on this highly concentrated product is used in nearly every instance as a basis of payment for the milk and cream. The amount of milk used for a fat test is 17.5 milliliters (18 grams), and the amount of cream used for a fat test is either 9 or 18 grams, regardless of how large the volume or weight of the lot of milk or cream to be tested.

A moment's thought will show how careful and precise a tester's work must be with so small an amount of sample to work with, and also how accurate the equipment must be with which they do this work. After first having determined by examination that each applicant for a milk and cream tester's license or weigher's and sampler's license is thoroughly qualified, these licensees are constantly checked by agents of this bureau at irregular intervals, as often as circumstances will permit, to determine if their work is being accurately done.

The accuracy of all equipment used by these operators is subject, under the General Dairy Law of California, to the jurisdiction of this bureau and is also checked for accuracy each time the work of an operator is checked. Each and every piece of sampling or testing equipment found to be inaccurate or defective is required to be either properly repaired and adjusted or is condemned and must be replaced by equipment that is accurate..

The financial welfare of both producers and purchasers of milk and cream depends upon accurate tests of these products for their milkfat content and without the control exercised by the commercial testing service of this bureau, inefficiency, carelessness, inaccuracy and dishonesty would soon prevail and the dairy industry in California would very soon reach a stage of chaos which ultimately would demoralize and ruin it, as small errors in testing, whether intentional or unintentional, would amount to hundreds of thousands of dollars per year in the aggregate.

At the close of the calendar year 1928 there were 652 testers and 555 weighers and samplers holding licenses. In the neighborhood of 100 each of testers, weighers and samplers fail to renew their licenses each year, so the total number remains fairly constant.

During the calendar year 1928, 539 check tests were conducted on the accuracy of the work of licensed testers.

9. Dairy Containers Exchange Service

The containers program, while comparatively a new one, at the close of 1928 is progressing very nicely. During the year just ended around 5,000,000 stray milk bottles were returned to their legal owners by the bottle exchanges throughout the state. Thousands of stray cans, cases and other dairy containers also were returned through this same medium.

A great number of milk cans as well as ice cream cans were returned to their rightful owners by the district dairy inspectors, who ordered containers returned that were being held and used by dairymen or factories not having right to their possession.

Bottle exchanges in northern California now cover the districts of San Francisco and peninsula, Oakland and all the eastbay cities, including the counties of Contra Costa and Marin, as well as San Jose, Santa Cruz, Watsonville, Salinas, Monterey, Stockton, Lodi, Modesto, Turlock and Tracy. The southern part of the state is covered by exchanges operating in Los Angeles, San Bernardino and San Diego.

The Stockton Bottle Exchange was started early in the year 1928, and is handling around 40,000 milk bottles as well as numerous cans and cases per month.

Section 18 (*b*) of the General Dairy Law provides for the registration of dairy containers brands with the Department of Agriculture. It is the duty of the department in turn to give protection on these containers. Many dairymen realize the value of this protection and to date 231 brands have been registered.

The industry in general has given the department wonderful support in inaugurating this program and within the next year a greater part of the state should be covered by containers exchanges.

10. Dairy Statistical Service

The compilation and dissemination of reliable statistics on the various phases of dairying, especially with respect to amount and value of production, the manufacture and distribution of the various dairy products, interstate movements, average cow production, average per capita consumption and utilization and trends, is a function of the bureau requiring much time and effort. That the efforts are well spent is evidenced by the large and increasing demand for the annual statistical report, both from within and without the state. The demand for statistics on the per capita consumption of the various products has been especially active.

It is only through the most efficient organization of all facilities at hand, together with the fullest cooperation of the dairy industry, that it has been possible to prepare our statistical report in its present adequate form.

The statistical report on dairy products for the year 1928 shows an increase in the total production of milk fat, an increase in the amount of manufactured products with the exception of butter and evaporated milk, and an increase in the per capita consumption of dairy products except butter, which shows a slight decrease. The largest gains are noted in cottage cheese and skim milk powder, two valuable by-products.

Although the production of milk fat is increasing, it is still necessary to import approximately 25 per cent of the butter and 70 per cent of the cheese consumed in this state. The total value of manufactured dairy products is over $151,000,000 and the farm value of milk fat is over $88,000,000. The figures given below illustrate the trend of dairy products consumption and the utilization of milk fat in the various products.

Per Capita Consumption of Dairy Products

	1925	1926	1927	1928
Market milk	25.6 Gals.	24.5 Gals.	27.3 Gals.	27.7 Gals.
Butter	21.7 Lbs.	22.2 Lbs.	23.2 Lbs.	21.98 Lbs.
Cheese	6.47 Lbs.	6.42 Lbs.	6.64 Lbs.	6.81 Lbs.
Cottage cheese	2.54 Lbs.	2.46 Lbs.	3.0 Lbs.	4.02 Lbs.
Ice cream	2.63 Gals.	2.69 Gals.	2.90 Gals.	3.02 Gals.

Utilization of Milk Fat Produced

	1925 per cent	1926 per cent	1927 per cent	1928 per cent
Market milk	26+	27.6	28.79	29.56
Butter	48+	46.1	43.43	42.33
Cheese	1.9	1.6	1.87	1.97
Ice cream	5	4.7	4.65	4.91
Market cream	9	11.6	9.15	9.56
Evaporated milk	8	8.3	9.41	8.49
Miscellaneous	—	—	2.7	3.18

DIVISION OF CHEMISTRY REPORT FOR 1928

FIRMAN THOMPSON, Chief.

THE policy of the Division of Chemistry in the enforcement of the Spray Residue Act has been to strictly follow the rules and regulations of the Federal Pure Food and Drug Act, in so far as they relate to spray residue on fresh and dried fruits, and vegetables.

Up to the present time no action has been taken nor regulations made with reference to other than arsenical sprays. For this reason our attention has been given to arsenical residue only, although we have received some complaints that other spray materials should also be included, particularly Bordeaux mixture on celery.

For the year 1928, the spray residue tolerance was set at 0.020 grain per pound, which was 0.005 grain lower than in 1927. As might be supposed, this was a little more difficult to reach, especially where hand wiping methods were used. It is expected that this tolerance will again be lowered for 1929 and it may even be set at 0.01 grain per pound, which is the ultimate goal.

During the season of 1928, the use of wiping and washing machines increased very considerably, indicating that expensive hand cleaning methods are being abandoned and that the industry is accepting the fact as a permanent policy that fruit must be cleaned when prepared for market. In fact, many people are recognizing that this is good practice for business reasons alone.

In the Yucaipa district, which is one of the most heavily sprayed districts in the state, some acid washing equipment was used for the first time. This district is also the most difficult to control from an inspection standpoint as the shipments are practically all by truck to the Los Angeles market. In the Santa Clara Valley, another heavily sprayed district, acid washing has come to be almost universal and there has been no difficulty whatever in reaching the export tolerance. In the Sebastopol and Watsonville districts spray programs are so light as to require either no cleaning at all or at the most, only dry wiping.

The most serious problem now in sight is with dried pears. These are largely exported and according to the ruling of the Federal Bureau of Chemistry, should meet the export tolerance of 0.01 grain per pound. Since it is not feasible to clean the fruit after drying and since it requires about five tons of fresh fruit to make one ton of dried fruit it will be necessary to clean the former below the limit of 0.0020 grain per pound in order that the dried product may be within the export tolerance. To accomplish this, thorough acid washing is necessary. In some districts only culls and windfalls are used for drying and in many cases the drying is done in small lots by the growers themselves. Many commercial dryers have installed acid washing equipment.

It has been the custom of the division to analyze all export shipments of fruit and to furnish a certificate to the shipper showing that such shipment was below the export tolerance. This service was very much appreciated by the shippers and its value is indicated by the fact that no seizures of export fruit have been made since its inception. Two

thousand one hundred fifty-six certificates of this kind were issued in 1928, as compared with 1606 in 1927. This requires the temporary employment of several chemists and is a considerable item of expense. A number of shippers have stated that such a service extended to domestic as well as export shipments, would be of considerable advantage and have indicated their willingness to pay a fee sufficient to cover the cost of such a service. Believing that everything possible should be done to aid in the marketing of fresh fruit it is recommended that a small fee be charged and certificates of analysis furnished on request for domestic as well as export shipments.

Fertilizers

The outstanding development in the fertilizer industry during the year was the appearance of a number of new products. For the most part, these were synthetic nitrogen products made by fixation of atmospheric nitrogen. This is a result of the tremendous impetus given this phase of chemical industry. Nitrogen compounds are the basis of all high explosives. The Central Powers, being cut off from all supplies of Chilean nitrate, were under the necessity of inventing and developing fixation methods. The result has been that the fixation of atmospheric nitrogen has become a firmly established industry and has already reduced the price of fertilizer nitrogen considerably. In addition to this, other fertilizer constituents are being manufactured in the form of highly concentrated salts. While a few years ago the average mixed fertilizer carried 15 per cent or less of plant food it is now possible to obtain such mixtures with 50 per cent or more of plant food. The fertilizer industry is rapidly becoming a true chemical industry.

During the year 1928 the usual inspection and analysis of fertilizers has been continued. Four hundred seventy-seven official samples have been analyzed by the laboratory as compared with 421 samples the previous year. The tonnage reports for the last quarter of 1928 are not yet complete but it is estimated that they will reach 117,000 tons, as compared with 102,524 in 1927. Ninety-three fertilizer licenses were issued during the year.

Agricultural Minerals

The Agricultural Minerals Act, passed in 1923, was designed to regulate the sale of such natural products as limestone, gypsum, etc., which were not included under the Fertilizer Act. At that time the line of demarcation between these two classes of materials was well defined. With the appearance of the above mentioned new fertilizer materials, various mixtures of true fertilizers with agricultural minerals are now being made. It is thus becoming more and more difficult to determine which law should apply to certain products. Inasmuch as these two laws differ materially in some respects it seems logical that a new one should be written to cover the whole field of soil amendments and to take the place of the two laws now in force.

The estimated tonnage of agricultural minerals for the year 1928 is 87,450 as compared with 60 214 tons for 1927. This shows an increase of approximately 45 per cent as compared with an increase of

about 15 per cent in fertilizer tonnage. Thirty-nine licenses authorizing the sale of agricultural minerals were issued during the year.

Fertilizer Salesmen's Act

This act has only been in effect since July 29, 1927. It provides that every firm or person engaged in the sale of fertilizers or soil amendments of any kind must be licensed by the Department of Agriculture. Misrepresentations of any kind on the part of the salesmen are forbidden and the penalty is severe. The law also provides that anyone may file a complaint and that a hearing may be held to investigate the charge. The license of the party concerned is revoked if sufficient reason therefor exists. About 1500 licenses per year are issued under the provisions of this act.

Economic Poisons

Any material used for the control of plant or animal pests is included under the legal definition of "economic poisons." Obviously this covers an extremely wide range of materials, many of which are not poisons in the commonly accepted meaning of the term. The inspection and analysis of such widely different substances is especially burdensome and it is safe to say that they take up the largest amount of time and effort on the part of the laboratory. California undoubtedly leads all other states in the production and use of economic poisons and their control is a matter of considerable importance to the agricultural interests. The law not only provides that the guaranteed standards of quality be maintained but gives the Director of Agriculture power to prevent the sale of worthless products. An amendment to the law increasing this power has been drafted and will be presented to the legislature of 1929. This amendment has the endorsement of the agricultural interests and of the insecticide manufacturers as well. Three hundred four paid licenses were issued under this act during 1928.

A statement of the collections of the division is attached hereto and also a report by Mr. Hoyt on the activities of the Dairy Laboratory for the year.

FEES COLLECTED FOR CALENDAR YEAR 1928

Licenses	
Agricultural minerals	$1,950 00
Economic poison	15,200 00
Fertilizer	4,650 00
Fertilizer salesmen	1,729 00
Tonnage Tax (last quarter estimated)	
Agricultural minerals	8,744 89
Fertilizers	27,691 04
Analysis Fees	
Fertilizer and agricultural minerals	208 00
	60,172 93
Glassware testing	2,989 27
	$63,162 20

DAIRY LABORATORY*

The work of the dairy laboratory has been conducted in the same manner as in previous years. It consists in the testing of milk and cream samples for the purpose of checking the accuracy of testing

*C. F. Hoyt, Chemist in Charge Dairy Laboratory.

done in factories of dairy products; the analysis of various dairy products for compliance with legal standards; the examination for accuracy of apparatus used for the testing of dairy products; and the investigation of individual problems as they arise in the course of the work. For doing this work, in addition to the person in charge, there are three chemists, one bacteriologist, two laboratory assistants and one clerk. Seven thousand, six hundred fifty-four samples have been analyzed, involving 13,766 determinations; also 41,576 pieces of apparatus have been examined.

During the early part of the year the laboratory was moved from its former location in an old store building to quarters in the basement of the State Office Building. The greater space available provided a relief from the former extremely crowded condition. It involved, however, a partial interruption of regular work for a considerable period while adjustments were being made.

During the year a large part of the work has been devoted to the examination of ice cream and ice milk samples collected by inspectors all over the state for enforcement of the recent law establishing standards for these products. They have been examined for fat, solids and bacteria content.

A pamphlet has been prepared and published giving methods for sampling and examining samples of ice cream. This was done for the purpose of encouraging uniformity of procedure in the different laboratories and was deemed necessary by reason of the fact that the extensive examination of ice cream throughout the state is a recent development.

Considerable time also has been used in the development of methods for the estimation of egg yolk in ice cream. This work is still in progress, and, although it is too early to make a final report, it is believed success will result.

A report has been completed and published on the use of the lactometer for determining the percentage of solids in milk. This report gives some facts not generally recognized by the users of this instrument and should be of material assistance in securing uniform results.

Considerable time has been given to the study in manufacturing plants of difficulties caused by heat resistant organisms in milk. With the more general and more effective use of methods for eliminating bacteria that are killed by a moderate degree of heat, organisms with a higher thermal death point are making their presence felt, and a means for controlling them becomes increasingly desirable.

Some work has been done in investigating a difficulty in the preserving of milk samples by corrosive sublimate tablets. These samples are required by law to be held for examination by state inspectors and of course a satisfactory preservative is necessary. A report on this work has been published.

A report has been prepared and published on the composition of California creams which gives a record of numerous determinations that have been made on samples of cream of known purity. They include various constants for milk fat, as well as values for the ash and alkalinity of ash. These records are of value as a basis of comparison by which to judge the purity of creams and other dairy

products suspected of adulteration. Accumulation of this information is being continued as opportunity permits.

Considerable work had been done during the preceding year and this year in determining the effectiveness of different methods of sterilizing and drying milking machine tubes. A report has been prepared giving the results of this study.

Several other problems that have arisen in connection with the work have been investigated, but, because of their somewhat minor character, they are not mentioned here.

Standard solutions have been regularly prepared for the use of inspectors in the field. Instructions in the making of different determinations, and examinations for a tester's license have been given to various persons. Also questions have been prepared for the use of inspectors in giving these examinations.



FIG. 128. When large scale spraying operations are undertaken the dependability of the spray is very important. The cost of this spraying for the control of the elm leaf beetle is approximately $1 a tree.

DIVISION OF ANIMAL INDUSTRY

J. P. IVERSON, Chief

DURING the past year owners of live stock in California appear to have shown marked evidence of an increased interest in the subject of animal health and in no previous year have they made the numerous and diverse requests for assistance.

Illustrative of this is the marked growth which has occurred in the tuberculin testing of dairy cows under the Pure Milk Law. In this work alone in 1928, there has been an increase of more than twenty-nine thousand cattle included in a total of 162,410 tuberculin tests applied to dairy cows for the control of tuberculosis and the protection of public health. Tuberculosis eradication by the area plan was also materially extended by the addition of Shasta county, thus adding more than thirty thousand cattle to the area eradication project. The number of herds supervised under the accredited herd plan likewise was augmented materially and the total number of cattle included in this activity increased approximately forty-five per cent over the previous year.

The year just passed, covered in this report, has been considered fairly free from any troublesome outbreaks of animal disease. Possibly this is due in part to what has been mentioned; namely, the extended opportunities for the service of veterinarians and a better appreciation of the economic value of this class of service by stock owners, who avail themselves of this benefit through assistance rendered by veterinarians engaged in private practice as well as in official work.

Unfortunately, many serious diseases of live stock are endemic in California, and in some sections certain parasites cause considerable trouble. However, we should consider it fortunate that no new disease or parasite was permitted to gain a foothold among our live stock during the past year. As an illustration, scabies in cattle may be cited. This disease has caused much loss to stock owners in the middlewest and Rocky Mountain regions for more than a quarter of a century. Scabies has never been permitted to spread in California cattle since prompt eradication measures have always been successful in stamping it out. This proved to be the case during the fall of 1928, when a shipment of cattle from a neighboring state, after arrival in the Imperial Valley, was found to include a number of scabby animals.

Almost comparable to this disease is scabies in sheep, which, while formerly widespread and affecting most flocks, has been reduced to a minimum, and for several years California has been free from losses occasioned by this parasite. However, as in the case of the cattle shipments despite the regulations in force, sheep from neighboring states have been the means of bringing into California greater numbers of scabby animals than have been found in all of our home-owned sheep. In every instance the disease was found early and effective eradication measures were successful.

Parasites, both internal and external, have been the cause of losses in live stock. Frequently the existence of internal parasites has been unsuspected by the owner, and occasionally his veterinarian ascribed the condition to other causes. The investigations conducted during

1928 and the previous year clearly demonstrate that internal parasites are quite widespread in California and play an important role in the reduction of the stockmen's income, for they not only cause unthriftiness in the various classes of animals, but the mortality is often considerable. External parasites—scab mites, ticks, lice, and other vermin—are fairly well known to the stockman who is familiar with remedies for their control, but the internal forms are more difficult to combat.

TABLE No. 1

Diseases Reported by Counties During 1928

County	Abortion	Anaplasmosis	Anthrax	Blackleg	Glanders	Hog Cholera	Ostertagia (Ostertagi)	Diseases-Cattle	D-Dogs	D-Goats	D-Hogs	D-Horses	D-Poultry	D-Sheep	Total
Alameda						4					2			1	7
Amador								1							1
Butte			30			6		2		1		1		2	42
Calaveras				2				1						1	4
Colusa						1		2			1			3	7
Contra Costa			1			2								5	8
El Dorado				1				1		1					3
Fresno					1			1							2
Glenn								2			3			4	9
Humboldt														1	1
Imperial					2							2		1	5
Inyo												1			1
Kern			1			1					2			1	5
Kings			1								1				2
Lake				1										1	2
Lassen								6				1			7
Los Angeles			2	1									1		4
Madera								1							1
Mariposa								1							1
Mendocino						4					3			6	13
Merced			10	1	1	1		5			2			1	21
Modoc								2						1	3
Monterey			4			3					4			1	12
Napa						2								1	3
Orange			1							1					2
Placer												1			1
Plumas								1						1	2
Riverside						1		1							2
Sacramento	1				1		1	3			1			2	9
San Benito		1										1		2	4
San Bernardino								1							1
San Diego						3		1			1				5
San Joaquin				1	1	14		2			2			7	27
San Luis Obispo						1		2				1	1		5
San Mateo						1									1
Santa Barbara		1	1	1		3	1	3			3				13
Santa Clara			1	3		3								1	8
Santa Cruz								1							1
Shasta									1			1		1	3
Sierra														1	1
Solano			6			3								5	14
Sonoma	1		1		1			1						8	12
Stanislaus			1	1			1	8						3	14
Sutter			1		1						1			1	4
Tehama								1			3			2	6
Tulare											2				2
Ventura								1							1
Yolo								1						2	3
Yuba														1	1
Totals	2	2	61	12	8	53	3	52	1	3	31	9	2	67	306

During the past year, general live stock conditions have shown improvement, especially noticeable in the case of range cattle. A serious depression reduced this branch of animal husbandry to a very precarious condition following the war, and many outfits were forced

to go out of business. Fortunately, the improved outlook for cattlemen may be expected to continue for a normal period.

The situation in reference to dairy cattle also was encouraging during 1928, the number of milch cows showing some increase over the previous year. Also the larger number of dairy cattle imported during 1928 is indicative of the dairymen's opportunity to raise heifer calves to supply this demand.

Our sheep industry progressed satisfactorily and shows an increase in the number of animals.

Horses and mules, however, so long the most important source of power for farm work and transportation, continued to show a decline, while the number of swine remained about the same.

It should be borne in mind that no individual or organization however energetic and efficient can accomplish alone very much in so extensive an undertaking as that of combating disease in live stock in a state the size of California unless cooperation of the individual live stock owner and the industry in general is extended to those engaged in this work. Therefore, it appears in order to mention here that the exceptionally intelligent and energetic assistance the California stock owners extended to the Division of Animal Industry and its field representatives has made possible, to a material degree, any progress which may have been achieved in disease control. So long as there is whole-hearted cooperation between stock owners and the members of the Division of Animal Industry, progress in disease control and other activities will continue.

Tuberculosis Control

Experimental inquiries concerning the nature of tuberculosis have resulted in the discovery of certain facts essential to combating this disease. These facts have been discussed in detail, but because of their fundamental importance, it seems appropriate briefly to restate them.

Tuberculosis can be produced only by a specific germ and in the absence of this organism it can not develop. While the germ will live for a long time outside the animal body, it can not multiply until it invades the body tissues and when this happens the infected animal becomes the source from which the disease may be transmitted to humans and live stock. A tuberculous animal can be detected by means of the tuberculin test, thereby rendering segregation or slaughter possible. With the knowledge of these essential factors, it is useless to undertake the application of prevention and control measures until the farmer himself is enlightened regarding the logical application of these facts which scientific research has brought to light. When the live stock owner thoroughly understands the nature of the disease and realizes the possible serious damage it may cause in his herd, eradication by concerted efforts will be only a question of time.

While the economic importance of tuberculosis is determined, in a large measure, by its prevalence and extent, nevertheless, it will be a grave error to assume that a small percentage of animals infected in any given section in California will not grow to large proportions if the possibilities for spread are not overcome by adequate control measures.

It is needless further to discuss the loss sustained by dairymen whose herds have been invaded by this pernicious malady for it is generally realized that a tuberculous dairy cow, as compared with a healthy animal, is not only a financial liability, but is a menace to the health of animals and humans.

With the knowledge available, it is obvious that serious thought should be given to the extermination of this plague which is seriously hampering our animal industry through the impairment of health and great financial loss to those engaged in the raising of live stock.

The first tuberculosis legislation in California was the enactment of the Pure Milk Law in 1915 requiring that all cattle including family cows from which milk is sold raw should be officially tuberculin tested. In herds in which no reactors are found the test is repeated annually, while those having reactors are tested semi-annually. Any person desiring to sell raw dairy products is required to make application to the Division of Animal Industry, Department of Agriculture, Sacramento, California, for a tuberculin test. All animals found diseased are branded with a letter "T" on the left jaw and removed immediately from the milking herd. Since this work was undertaken, there have been made 1,108,475 tuberculin tests of cattle producing dairy products to be consumed raw.

This provision of the law not only serves as a splendid health measure but also has enabled dairymen to establish clean herds and maintain them free from tuberculosis. The records show that dairymen in several counties who have taken advantage of the benefits accruing from this law and who have made an earnest effort to follow the logical sanitary requirements have not only succeeded in establishing clean individual herds but, by their cooperation with the department, have practically eradicated the disease from their counties. This has been practically accomplished in San Diego, Ventura, Mendocino, Lake, Placer, Nevada, El Dorado, Amador, Tuolumne, Calaveras, and Inyo counties. With the increased attention given to the testing of dairy herds under this law in the counties of Orange, Riverside, San Bernardino, San Luis Obispo, Santa Barbara, and others, it appears safe to predict that this method of control eventually will result in a material reduction in tuberculosis from areas in which tuberculin testing of dairy cattle on any extensive scale was carried on primarily for the protection of public health. The increasing demand of consumers for dairy products from healthy cows has greatly enlarged the scope of this work, and dairymen, encouraged by good prices, are resorting to the slaughter of reactors rather than transferring them to untested herds where they may continue a menace to the plan of control developed under this law.

The Pure Milk Law does not require the slaughter of reactors, but their disposition must be reported to the department. Data thus accumulated reveal that an unusually large percentage find their way to slaughtering establishments.

TABLE No. 2

*Official Tuberculin Tests of Dairy Cattle Required by the Pure Milk Law if Dairy Products are Sold Raw

Counties	Herds tested	Herds of 10 animals or less	Herds of 10 animals or less free	Herds of more than 10 animals	Herds of more than 10 animals free	Animals tested	Reactors
Alameda	121	99	85	22	6	1,445	122
Amador	67	50	50	17	14	628	39
Butte	374	300	273	74	38	2,541	72
Calaveras	28	21	21	7	4	235	2
Colusa	95	80	74	15	8	711	28
Contra Costa	212	165	149	47	12	2,763	211
Del Norte	56	17	14	39	25	1,788	58
El Dorado	100	80	78	20	12	1,306	23
Fresno	886	736	704	150	51	8,073	583
Glenn	108	80	77	28	21	991	13
Humboldt	503	369	337	134	75	6,063	268
Imperial	44	9	8	35	10	2,069	74
Inyo	58	37	35	21	16	1,152	22
Kern	201	86	75	115	52	6,042	305
Kings	40	27	25	13	3	1,008	31
Lake	126	103	100	23	21	735	7
Los Angeles	998	574	541	424	149	33,689	1,411
Madera	60	40	36	20	9	1,041	95
Marin	61	26	22	35	26	1,530	22
Mariposa	10	7	6	3	1	162	10
Mendocino	355	235	221	120	94	4,559	77
Merced	56	39	35	17	4	543	30
Mono	10	9	8	1	1	64	1
Monterey	80	58	52	22	11	1,032	32
Napa	110	95	88	15	8	989	30
Nevada	80	47	45	33	28	874	6
Orange	424	340	326	84	28	4,858	362
Placer	166	141	133	25	14	1,262	48
Riverside	279	195	188	84	37	5,155	288
Sacramento	263	231	216	32	29	1,560	31
San Benito	67	53	48	14	7	493	18
San Bernardino	379	226	199	153	51	9,446	611
San Diego	642	396	392	246	183	11,856	158
San Francisco	1	1				8	2
San Joaquin	142	99	90	43	11	2,848	281
San Luis Obispo	135	99	95	36	19	2,121	60
San Mateo	123	101	93	22	6	1,030	183
Santa Barbara	139	53	49	86	30	8,192	567
Santa Clara	389	304	287	85	37	4,482	311
Santa Cruz	257	209	203	49	20	2,172	42
Sierra	2			2	1	69	2
Siskiyou	75	32	28	43	28	4,672	85
Solano	72	54	53	18	8	1,476	48
Sonoma	432	356	318	76	35	4,140	179
Stanislaus	182	145	131	37	12	1,797	104
Sutter	87	72	65	15	3	868	40
Tulare	493	391	369	102	44	4,732	215
Tuolumne	61	37	34	23	16	786	28
Ventura	145	105	103	40	18	4 381	62
Yolo	119	99	87	20	8	1,381	51
Yuba	52	36	31	16	8	592	46
Totals	9,965	7,164	6,697	2,801	1,352	162,410	7,394

* Tests made by veterinarians of Division of Animal Industry including a few herds tested by city veterinarians.

TABLE No. 3

Results of tuberculin tests applied under the Pure Milk Law during the past five years:

Year	*Animals*	*Reactors*
1928	162,410	7,394
1927	133,358	7,782
1926	122,248	5,734
1925	103,319	5,731
1924	44,538	2,673

The splendid results achieved through the operation of this law created a lively interest in the adoption of more extensive control measures; consequently, in 1921 two enabling acts were passed by the legislature which made it possible for the state and federal depart-

ments of agriculture to cooperate in eradicating tuberculosis from individual purebred or high class herds in various parts of the state by the method known as the accredited herd plan, and from counties in which the percentage of tuberculosis in cattle did not exceed ten per cent under the area plan of tuberculosis eradication. Since these plans became operative, there have been placed under official supervision throughout the state 269 herds, 106 of which are accredited, that is, pronounced free from tuberculosis, and 163 in the process of accreditation.

Under the area plan tuberculosis has been practically eliminated from the counties of Modoc, Lassen, Plumas, Tehama, and Shasta. Following a recent request from the supervisors of Siskiyou County that tuberculosis eradication be undertaken there, arrangements are being made for an official survey of the situation in that area in the near future. Several other eligible counties are contemplating similar action, indicating the confidence of live stock owners that by concerted efforts it is possible to control and eradicate tuberculosis.

TABLE No. 4

The following data show the amount of tuberculin testing conducted in 1928 under the area plan of tuberculosis eradication:

County	*Animals*	*Reactors*
Lassen	8,693	76
Modoc	12,893	27
Plumas	6,906	39
Shasta	35,064	374
Tehama	17,545	167
Prior to entrance	1,760	25
Totals	82,861	708

Restrictions Governing Tuberculin

A number of provisions were included in the Bovine Tuberculosis Law to regulate the sale and restrict the use of tuberculin. These requirements became effective July 29, 1927, and have now been in operation for seventeen months. The act regulates the manufacture of tuberculin and requires that its sale, distribution, and use must be reported. The purchase, possession and use of the product are restricted to veterinarians approved by this department. To make tuberculin testing more effective, the statute also provides for the identification of reacting animals. Supervision over these functions has required considerable time by this division, both in the office and in the field.

The widespread interest in the subject of tuberculosis regarding public welfare and for economic reasons of the industry has stimulated increased activity in control of the disease. This has been reflected in the increased number of requests by owners for tuberculin tests. According to the reports received, there was an increase over 1927 of about forty-two per cent in the average number of animals tested by practitioners per month during this year. The following is a summary of these reports:

Tests	*Animals*	*Reactors*	*Suspicious*
10,314	147,214	14,273	2,612

These data are made available because all tests applied by veterinarians approved to use tuberculin must be reported within five days.

These tests were made at the request of owners, and are not included in official state and federal tests. There is considerable variation in the number of reactors found in different localities; therefore, the foregoing figures should not be construed to be a cross-section of the extent of infection among the entire cattle population of the state.

The law requires the identification of all animals reacting to the test. Grade cattle must be branded with the letter "T" on the left jaw, and reacting registered purebreds may, if desired by the owners, be identified until July 1, 1929, by filing with the department the registration names, numbers, and photographs of such animals, provided the animals remain on the premises where tested. Before they can be removed, they must be branded with the letter "T." Of the above number of reactors, seventy-four registered purebreds have been identified according to this special provision.

The sale and distribution of tuberculin must conform also to certain requirements. Only such tuberculin as is produced by laboratories holding a federal license can be sold or disposed of in this state. All sales must be reported to the Department of Agriculture, and in this respect the various laboratories apparently have rendered excellent cooperation. The following summary of these reports shows the amounts of tuberculin sold in the state during 1928:

Intradermic	*Subcutaneous*	*Ophthalmic*	*Avian*
24,936 c.c.	1,472 c.c.	4,190 discs	147 c.c.

A federal license No. 192 for the production of tuberculin was issued on March 13, 1928, by the U. S. Department of Agriculture, Bureau of Animal Industry, to the laboratory operated by this division. The tuberculin made in this laboratory is for official use of the state's field veterinarians.

The act provides that only veterinarians approved by the Department of Agriculture can buy, possess, or use tuberculin. This office has endeavored to maintain close contact by means of circular letters and personal visits with practitioners in order that they may keep informed regarding the requirements pertaining to the use of the product. Suggested procedures to follow and publications on the subject have been forwarded veterinarians in order that so far as possible the accurate application of tuberculin tests may be promoted.

At this time there are 486 approved veterinarians on the list. Because approval has been granted a veterinarian, the department does not assume responsibility for the tests he may apply, nor does such approval signify a guarantee of his work. The continuance of approval depends upon the integrity of the user. During the year it has been necessary, for sufficient reasons, to drop five names from the list, while seven were suspended for limited periods.

Occasional violations of the provisions of this law have been disclosed. It has been possible to adjust most difficulties, but in six instances, irregularities occurred which required court action. The fact that convictions were secured in every case indicates that care was exercised in prosecuting only wilful violations. Three cattle owners were arrested for unlawful possession and use of the product, and another for refusing to brand reactors. A druggist violated the statute by possessing tuberculin and selling it to an unauthorized party. A dairyman was

convicted of bringing tuberculin from another state and using it in applying tests.

The field veterinarians of this division have carried out that provision of the statute which requires the retesting of purebred cattle sixty to ninety days after they are transported to this state.

TABLE No. II

Summary of Animals Tuberculin Tested in 1928

	Animals tested	*Reactors*
Pure Milk Law	162,410	7,394
*Accredited Herds	26,478	346
*Area Eradication	81,101	683
*Miscellaneous tests	2,779	72
Totals	272,768	8,495

*Includes tests made cooperatively by federal and state employees.

Sheep Diseases

In California the sheep industry alone represents an annual investment of some forty millions of dollars. At existing prices this investment pays an annual gross income from lambs and wool alone of more than twenty-one millions of dollars, absorbing an annual death loss in excess of three millions of dollars, with probably twice that amount from lack of condition resulting in feeder lambs and poorer grades of wool instead of fat lambs.

About three years ago the problem of sheep losses was observed to be growing at an alarming rate, and the Division of Animal Industry deemed it sufficiently important to conduct investigations in this direction when the opportunity presented. The work was fruitful as evidenced by the results obtained. The attention of the woolgrowers, the U. S. Bureau of Animal Industry, and the University of California was also directed toward this problem. The work progressed at such a rapid rate that at times it was difficult for the investigators to meet the demands for service. In order to further the work and establish a closer contact between the cooperating agencies, the California Woolgrowers' Association organized a sheep disease committee. Meetings were held quarterly to discuss matters of general interest and hear progress reports.

For the sake of brevity, it is believed necessary only to list the accomplishments during the period as follows:

1. Discovery of the *Ostertag* stomach worm throughout sheep raising districts.

2. Demonstrating that California sheep are generally free of the true stomach worm, *Heamonchus contortus*.

3. The discovery that hookworms of sheep are prevalent in the coastal areas.

4. The demonstration of an effective treatment for the *Ostertag* and hookworms. The use of tetrachlorethylene in doses of 5 c.c. for sheep and lambs over 40 pounds is recommended; to those under forty pounds, 2½ c.c.

5. The discovery that liver flukes are the primary cause of extensive sheep losses in certain sections.

6. The introduction and use of carbon tetrachloride against liver flukes.

7. The finding of the snail which is suspected of being the intermediate host.

8. The devising of a copper sulphate dust or spray with methods of practical application, conclusively demonstrating that copper sulphate is an effective, cheap snail destroyer.

9. What appears to be the greatest of all—the gaining of the cooperation, confidence and endorsement of the sheep industry.

These are accomplishments of far reaching significance and ultimately will result in marked benefit to the industry.

The Department of Agriculture has not rested at this point. Woolgrowers were faced with other losses, the explanation of which, at times, seemed rather difficult. These losses were generally encountered when sheep were suddenly put on feed rich in protein to which they were unaccustomed, such as found in feed lots and on grain stubble. The lesions observed in animals dying from this condition resemble those described for animals affected with hemorrhagic septicemia. It has been demonstrated that by placing such sheep on a diet of alfalfa hay, or grain hay with bran, for a few days and then gradually bringing them to full feed, the disease will cease almost immediately. It is for this reason the Division of Animal Industry has not advocated the general vaccination of sheep against hemorrhagic septicemia. From the results obtained, we are of the opinion that this disease is due to dietetic errors, and not to any one pathogenic organism.

During the spring and summer of 1928, California was unfortunate in having a widespread outbreak of foot rot caused by the necrophorous organism. In some sections, the sheep interests became quite perturbed and even went so far as to advocate quarantine measures. Under the guidance of the department and with the aid of the Woolgrowers Association, these fears were allayed.

The organism which causes this disease manifests its activities in many different forms and at times may lead to serious losses. It is a condition that requires drastic treatment, but responds readily to properly applied remedial agencies. After proper trimming of the affected feet, hot applications of a saturated solution of copper sulphate have given very satisfactory results.

TABLE No. 6

Inspections and Dippings of Cattle and Sheep for Scabies, 1928

	Cattle	Sheep		
			Dippings	
	Inspections	*Inspections*	*Exposed*	*Infected*
January		156,454		
February	750	127,809		
March	56	311,875	3,258	12,575
April		288,116		21
May		127,960		2,800
June		83,111		
July		99,329		
August		162,910		1,265
September		87,620		
October		158,590		
November		85,468		
December		154,369		
	806	1,843,611	3,258	16,661

Meat Inspection*

State meat inspection has taken a decided step forward during 1928, as will be shown by the chart submitted herewith.

The total number of plants now operating under our supervision is 124 and approximately 350 other slaughterers are having their slaughtering done at many of these establishments, finding it more profitable than maintaining small plants of their own. At the present time fourteen plants are being remodeled and five new slaughter houses erected at an approximate cost of $150,000. The intention of most of the owners of these establishments is to operate under state inspection as soon as construction work is completed.

At present nine counties and sixty-seven cities have passed ordinances prohibiting the sale of other than state or federal inspected meats within the jurisdiction of these ordinances and many others are considering similar action.

One of the strongest arguments for this action in so many communities is the fact that throughout the state may be found advertisements in the press and by placards, offering to buy live stock *good or bad* and stating that the buyers will pay cash for such live stock whether or not it is passable under inspection. This state of affairs naturally is causing the people of the state to suspect that the meat of such carcesses, known to be diseased at the time of sale to these traders, is sold for human consumption, and they are unwilling to see such meat come back into their communities. Hence, the ordinances mentioned for their own protection.

A strong sentiment is growing throughout California for statewide and compulsory meat inspection so that the meat industry will operate under uniform regulations, and a move is on foot now among the legitimate meat interests and the live stock industry to favor state-wide inspection of all meat and meat food products.

SUMMARY OF STATE MEAT INSPECTION

Year	Cattle	Calves	Sheep	Swine	Goats	Rabbits	Buffalo	Total
				Animals Inspected				
1922	28,757	26,537	56,363	34,858	658			147,173
1923	61,387	56,402	106,956	82,900	990			308,635
1924	105,563	121,018	164,769	142,121	2,482			535,953
1925	137,682	155,707	137,823	129,294	2,187			562,693
1926	145,214	161,398	146,414	121,291	1,573		1	575,891
1927	144,307	153,304	137,621	131,633	1,568			568,433
1928	189,336	176,858	290,418	263,549	1,853	7,380		929,394
Total	812,246	851,224	1,040,364	905,646	11,311	7,380	1	3,628,172
				Animals Condemned				
1922	527	47	32	353				959
1923	950	94	87	433				1,564
1924	1,920	568	304	990	6			3,788
1925	2,904	867	395	1,038	17			5,221
1926	3,163	464	536	697	3			4,863
1927	3,111	650	443	700	5			4,909
1928	3,547	853	698	1,514	2	59		6,673
Total	16,122	3,543	2,495	5,725	33	59		27,977

Poultry

In accordance with the provisions of the proclamation issued in 1923, when European foul plague prevailed in some of the eastern states inspections are made of carload shipments of poultry originating

* George Gordon, In Charge.

in other states. These inspections are made prior to unloading. During the year no serious disease has been found in these importations, although some shipments contained poultry affected with conditions incident to exposure and improper handling.

A marked decrease in poultry importations has occurred this year. The regulations issued by several of the northwestern states requiring that all imported chicks must be certified as free from bacillary white diarrhea were tested in courts and found to conflict with federal regulations pertaining to interstate movements of live stock.

Poultry Pathological Laboratory

Since the establishment of this laboratory in April, 1927, the demands on it have steadily increased. The work involves diagnoses of poultry diseases and providing advice concerning their prevention, control and treatment. The staff at the present time consists of a director, provided by the State Department of Agriculture; two field veterinarians, supplied by the Los Angeles County Live Stock Department, who assist in the laboratory and conduct field work in the control of poultry diseases within Los Angeles County; and two assistants, one of whom serves part time, assisting when the demand for blood testing is heavy.

The field work in Los Angeles County, in many instances, has proved a valuable supplement to laboratory examinations, and every effort is made to coordinate these two lines of work to the end that they may be mutually helpful.

Blood testing for bacillary white diarrhea is on the increase as poultrymen realize more than heretofore the seriousness of this disease, and the importance of control. In general, reports from those who have done blood testing indicate that this measure, combined with proper management and sanitation is of much value. However, the means available are short of what is desirable in coping with this disease, and it is to be hoped that research, now in progress in various parts of the country, may provide improved or additional methods of control.

In the diagnostic work, records of each examination made are kept on special autopsy cards, which constitute a valuable permanent record in the laboratory, and facilitate the preparation of reports issued monthly.

During 1928, 1101 cases and outbreaks of disease and causes of loss were diagnosed in 2194 birds submitted to the laboratory for examination. The service rendered by the laboratory since its establishment has covered southern California in a very satisfactory manner. Material has been received from 171 different localities. During this same period, 66 different diseases and causes of loss have been diagnosed. During the calendar year 1928, 34,996 blood tests for bacillary white diarrhea were conducted in 229 flocks.

The more important diseases found have been: Bacillary white diarrhea, blackhead, chicken pox, colds, roup and canker, coccidiosis, enteritis, fowl typhoid, infectious bronchitis, paralysis, poisoning, ruptured yolk tumors and intestinal worms.

Fowl cholera is of infrequent occurrence. Tuberculosis has been encountered in but one instance, and this in a flock of birds imported from the middle west for breeding purposes.

Paralysis comes to the attention of the laboratory very frequently and apparently is widespread; but, fortunately, the incidence in flocks as a rule, is not high. It seems probable, as a result of recent researches, that our conceptions of the etiological factors involved in this disease are in need of revision.

Infectious bronchitis still continues to be a serious disease in this section of the state, but the indications are that its virulence is on the decline.

It is believed that the laboratory is giving material assistance to poultrymen of this section in meeting the serious problem of disease control.

TABLE No. 7

Cars of Poultry Shipped Into California from Eastern Points, January 1 to December 31, 1928

	Colorado	Idaho	Illinois	Kansas	Missouri	Nebraska	New Mexico	Oklahoma	Texas	Utah	Washington	Total
January	7	---	---	---	3	18	---	---	10	3	1	42
Febuary	1	2	---	---	--	2	2	---	10	1	1	19
March	2½	1	---	---	--	5½	½	3	23½	---	---	36
April	½	4	---	---	---	1½	---	1	30	---	1	38
May	---	5	---	---	1	3	---	---	2	3	2	16
June	---	3	---	---	1	4	---	---	2	2	---	12
July	---	7	---	---	5	10	---	---	---	5	---	27
August	---	5½	---	---	---	12	---	---	---	2½	---	20
September	1	2	---	---	---	18	---	---	---	---	---	21
October	6	2	---	---	4	27	1	---	---	---	---	40
November	2	7	---	3	5	26	---	---	---	1	---	44
December	8	8	1	1	7	14	---	1	---	1	---	41
	28	46½	1	4	26	141	3½	5	77½	18½	5	356

CATTLE PROTECTION SERVICE*

In 1927 the cattlemen of California, realizing that something must be done to protect their herds against theft which was assuming commercial proportions, framed and succeeded in having enacted into state law, a bill providing for the recording of cattle brands, the licensing of all slaughterers engaged in the business of slaughtering cattle and the inspection for brands and marks of all cattle before their acceptance by common carriers for shipment and before being slaughtered at commercial plants. There has never been any state appropriation made for carrying on this work, it being supported by fees received for slaughterers' licenses, the recording of brands, the renewal fees on same and in a very small degree, the amount accruing from penalties and the sale of estray animals, the owners of which in rare cases may not be found.

In the earlier days cattle stealing in California was confined principally to the occasional killing of a bullock for purely local use, and, at times, the driving off on foot of sizeable herds. Under conditions prevailing at this time, the latter method could be carried on with some chance of success. Such methods of plunder are now entirely out of date, owing to means of rapid communication. Through the coming

*By Arthur Hebbron, Secretary.

of improved roads and fast trucks, the scenes have shifted. Sometimes cattle stolen at night are slaughtered the next morning over one hundred and fifty miles away—long before discovery of the theft.

The great numbers of cattle pastured on the open ranges and large areas in California that are poorly fenced, make it necessary that a "fire brand" be used, as that is the only practicable way of showing ownership.

Under the present hide and brand inspection regulations no cattle can be accepted for shipment by any common carrier until they are inspected for brands and marks by a duly authorized hide and brand inspector, appointed by the director of agriculture, and the rights of ownership or possession of the cattle by the shipper or slaughterer fully established; also no cattle can be slaughtered in any slaughtering establishment without such brand inspection. As a further protection, a system of hide inspection is provided to permit a checking up and an inspection of all hides "taken off" cattle slaughtered in small slaughtering establishments too remote to permit of daily full-time brand inspection. Hides can not be removed from place of slaughter or accepted for shipment or transportation by any person until they have been inspected for brands and marks. In order to carry out this system of cattle and hide inspection, the brand records are of first importance, as they show the design of a brand, its location on the animal, the name and address of the recorder and the place where the cattle so branded generally range. A list of these records is compiled with due regularity and furnished to inspectors, that they may be fully informed as to ownership of any branded animal coming under their observation at time of inspection.

As a further benefit to the cattlemen, the state brand records made it possible to remedy the law pertaining to the sale of estrays. Chapter 726, an act approved June 3, 1921, requires that before any person can sell any branded bovine animal as an "estray" he must give the director of agriculture ten days' notice by registered mail of such proposed sale, describing the brands and marks on the estray animals, in order that the director may cause search to be made of the registered brands on file to determine the ownership and give notice to the owner before date of sale, where such cattle may be found and claimed. The need for this law is undoubtedly appreciated and could only be effectively enforced under the present system of brand registration. Many cattlemen now avail themselves of the opportunity to refer to the records in order to ascertain the ownership of any estray cattle they may find on their ranges and when the recorder of a brand on such reported estray cattle can be determined this office has been able to assist in restoring them to the rightful owner. To date our success has been very gratifying.

It frequently occurs that we are asked to find the owners of cattle carrying brands which do not appear on our records. These generally are cattle branded with "irons" being used illegally or cattle brought into California from adjoining states, which have not been rebranded with a California recorded branding iron.

In order to carry out the brand inspection requirements of the hide and brand law, it was necessary that a sufficient number of brand inspectors be appointed, authorized to inspect cattle and hides for brands and marks at all shipping points and to inspect cattle at all

slaughtering establishments prior to slaughter. On account of the small compensation that can be earned by many of these inspectors, particularly those needed to make brand inspections in districts where a limited number of shipments of cattle originate and where the loading corrals are far apart, and the slaughter houses are located at a distance from the home of the inspector, there is difficulty in securing inspectors properly qualified to perform this valuable and necessary service. Reading brands, at best, is a difficult job and only men who have had experience on the range can be considered good brand inspectors. In the fall of the year when the hair on an animal is long and hanging over a brand, it is often difficult to read. An inspector should be able to read brands readily, in order that the cattle under inspection can be handled with as little disturbance as possible. Such exacting work as this and the experience necessary, coupled with the inadequate compensation offered, for a time prevented the department securing competent inspectors, so the service was carried on under a considerable handicap. As the work advanced and the cattlemen began to feel the benefits arising through the efforts made to enforce the law, a gratifying cooperation developed that materially assisted the cattle protection service in improving its inspection force to the extent that the protection desired by the cattlemen is now being more efficiently given and our inspection force greatly improved. Our field branch inspection force is augmented by the work of a number of recheck inspectors located in the corrals at the large slaughtering centers and points of destination. These "recheck" inspectors check up the inspections made by the original brand inspector, in order to locate any cattle reported as missing. They also render weekly reports of all cattle arriving at these points.

The following figures show some of the work supervised by this service. These are for 1927, as figures are not completed for 1928:

Number of Cattle Shipped Out of Various Counties

Cows	192,124
Steers	261,977
Calves	122,485
Bulls and stags	10,977
Total	587,562
Number of cattle shipped out of the state	28,498
Number of cattle shipped into state for slaughter	164,527
Total number cattle slaughtered	1,198,802
Total number of cattle in state in 1928	1,995,000

During the year 1928, there were 1243 new cattle brands recorded in this office, an increase of 25 per cent over the previous year, which indicates that better conditions prevail in the cattle business. There are now approximately 10,000 active cattle brands recorded with this service.

There are many conditions in California that make brand inspection altogether more difficult and complicated that it is in most cattle producing states. California has approximately ten times as many shipping points as most of the individual cattle producing states and shipments are very numerous, but mostly in small lots. Number of shipments in more strictly producing states are comparatively small,

but usually represent large numbers of cattle. Cattle shipped from states that are most entirely producers are largely in one brand, there being very few importations of range cattle into those states, and comparatively few sales where cattle are turned out on some range within the state, while California is a very extreme importer of range cattle from seven different states, these being turned out on large ranges where they are at times mixed with cattle from different states, many of them bearing same brands as local cattle. Besides, there is a large intrastate shipment of cattle in California, which prevails to a limited extent in strictly range states. Cattle that are shipped into the Middle Western states mostly go into small enclosed pastures, in a level, open country, or directly into feed lots, from which they are shipped direct to markets to be sold for slaughter.

Here are some of the benefits of this act derived by slaughterers:

1. Prevents irresponsible parties slaughtering at various places.
2. Prohibits producers competition.
3. Slaughterers given same protection as cattlemen on any cattle they have on hand.
4. Protection against stealing of hides.
5. Helps to identify animal if carcass is condemned.
6. Can get legal title to estray animals from inspectors.
7. Helps to segregate cattle shipments that are at times mixed en route or at destination.
8. Can get figures showing volume of business at other points.
9. By getting bills of sale are in a measure protected against charge of stealing cattle.
10. Prevents substitution of cattle while being transported or delivered on foot.
11. No detriment, excepting small license fee.

While the inspection of cattle for brands and marks at time of shipment or slaughter is not infallible, it has been a great factor in preventing losses that could occur under the old system of shipping or slaughtering without restrictions and no inspection on hides.

During the year the following arrests were made:

Cattle Stealing

Madera County, 7—3 convicted, 2 discharged, 2 cases pending.

Siskiyou County, 1—party forfeited bail, left the country, has not been apprehended.

For Using Unrecorded Brands

San Joaquin County, 2—both convicted.

Slaughtering Without License

San Joaquin County, 2—1 convicted, fined $20; 1 discharged. 1 left country before warrant was served.

Failure to Pay Renewal Fees on Brand

Siskiyou County, 1—convicted, fined $100, fine suspended pending observance of law in future.

On Suspicion of Having Slaughtered Stolen Cattle

San Bernardino County, 1—convicted, fined $500.

San Diego County, 2—convicted, sentenced to six months in county jail.

Investigations by Three Special Investigators

465 cases of minor infractions of the law investigated and adjusted.

STALLION REGISTRATION LAW

The operation of this law has been effective in preventing the transmission to offspring of hereditary defects in stallions and jacks.

To those interested in the horse it is somewhat disappointing to realize that the purpose for which this law was intended will not accomplish the results contemplated for the reason that an inanimate power in the form of machinery is responsible for a considerable decrease in the horse population. It is as yet a little premature to predict what will happen to the horse in the future, but it is interesting to note that while machinery has superseded the horse in some instances, it has not succeeded in gaining the ascendancy on farms.

The competition by these two forms of power is gradually growing keener, and it is difficult to forecast the outcome of this struggle for mastery in serving the farmer.

ANIMAL PATHOLOGY LABORATORY*

The Animal Pathology Laboratory in many respects has been like Topsy. It started in a small way and then proceeded to outgrow its allotted clothing. For several years it was housed in one room, which became very congested and was poorly lighted. In July, 1927, the Bovine Tuberculosis Law became effective and in accordance with a provision therein it was necessary to procure a federal license to prepare and distribute tuberculin for use in official testing. Early in this year the old dairy laboratory was remodeled, providing commodious quarters, with better lighting facilities and meeting federal requirements for the preparation of tuberculin.

The laboratory functions along three distinct lines: The manufacture of tuberculin for use by field veterinarians in making tuberculin tests as provided by the Pure Milk Law; the examination of disease specimens submitted for purposes of diagnoses or confirmation of such, and the making of infectious disease investigations in the field by the laboratory worker.

The whole program of tuberculosis control hinges upon the effectiveness of tuberculin. It is important, therefore, that the veterinarians be supplied with a product at reasonable cost that is safe, and of sufficient potency.

Operating under a federal license occasions a considerable amount of additional detail which necessitates the employment of one full time assistant. During the year there were distributed 9427 vials, each containing 2 c.c. of tuberculin, constituting a total of 18,854 cubic centimeters. This quantity is less than the year previous because of a three-months' nonproductive period due to moving and rebuilding the laboratory.

The Division of Animal Industry is charged with the control or eradication of communicable diseases of domestic animals. In order efficiently to carry on this work it is necessary to have a laboratory where certain procedures necessary to establish a diagnosis can be made or confirmed. At times when it is necessary to enforce quarantine regulations, a field diagnosis may be questioned, requiring additional

* By Dr. Roy H. Mills, Senior Field Veterinarian.

evidence that the disease exists. It has been the policy of this Division to retain all specimens and evidence in these cases and the laboratory has been called upon many times to produce them, thus avoiding legal entanglements. During the past year 183 such specimens were examined and diagnoses made.

The Animal Pathology Laboratory receives no appropriation with which to conduct experiments or investigational work relative to the cause of certain losses as this comes within the province of a division not a part of this department. However, sometimes it is necessary to do some investigational work to determine measures for the control of certain conditions. About three years ago the problem of preventing extensive sheep losses was presented and since that time the Division

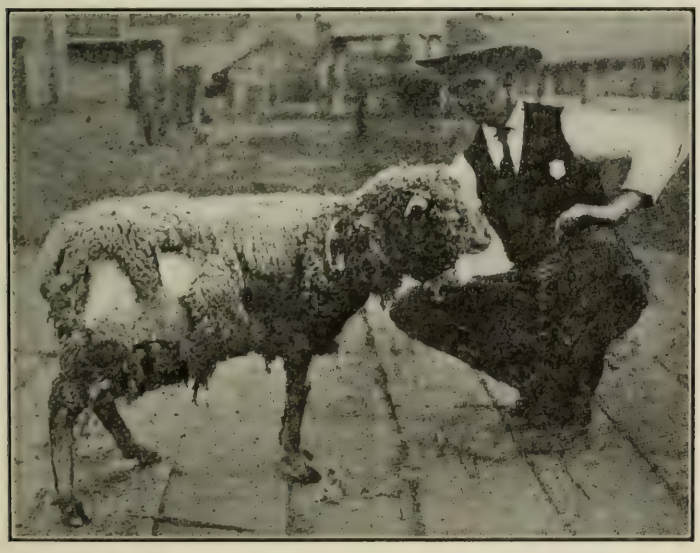


FIG. 129. Utmost vigilance is necessary to maintain our flocks free from the scourge of scabies.

has made much progress along this line. The first fact observed was that a large percentage of these losses was due to intestinal parasitism. Our veterinarian in charge of the laboratory has made numerous trips and investigations into the field and generally more satisfactory results have been obtained than were anticipated. A great many sheep and cattle owners are now reaping the benefit accruing from the results of this work. The work in parasitic diseases of our domesticated animals presents practically a virgin field in which a great service can be rendered to California's live stock interests.

One of the interesting accomplishments of the year was the working out of an efficient treatment for *Ostertag* disease in cattle. The treatment is inexpensive and has saved several head of purebred cattle which otherwise would have died.

TABLE No. 8

Interstate Shipments Showing States of Origin, Year of 1928

	Dairy cattle	Horses	Mules	Feeder sheep	Rams	Other classes sheep	Total
Arizona	2,751	132	12	65 881		127	68,903
Canada	17	47			1	1	66
Colorado	1,026	57	2				1,085
Connecticut	3						3
Idaho	4,914	118	28		3	310	5,373
Illinois	37	49					86
Indiana	1	2					3
Iowa	311				3	2	316
Kansas	90	4	65				159
Kentucky		40			5	40	85
Louisiana		5					5
Massachusetts	4						4
Michigan					1		1
Minnesota	175						175
Missouri	171	21					192
Montana	622	88			508		1,218
Nebraska	7		2				9
Nevada	1,820	86	49	97,008	739	234	99,936
New Hampshire	42						42
New Jersey	39						39
New Mexico	51	63					114
New York	4						4
North Dakota	2	2					4
Ohio						5	5
Oregon	6,829	77	3	25,391	1,057	4,572	37,929
Tennessee		17					17
Texas	954	2	1	14,000			14,957
Utah	3,778	430	14	23,954	430	304	28,910
Virginia	20						20
Washington	913	47			60		1,020
Wisconsin	719	11			3		733
Wyoming		58			65		123
Totals	25,300	1,356	176	226,234	2,875	5,565	261,536

TABLE No. 9

Interstate Shipments Showing Counties of Destination, Year of 1928

	Dairy cattle	Horses	Mules	Feeder sheep	Rams	Other classes sheep	Total
Alameda	134	54	1	2,794			2,983
Alpine	260				30		290
Amador	1						1
Butte	5	21		6,440	262	4,110	10,838
Colusa	2			1,200			1,202
Contra Costa	615			1,100			1,715
Del Norte	2						2
El Dorado	17				51		68
Fresno	1,196	12		11,545	201		12,954
Glenn	82	44			36		162
Humboldt					149	45	194
Imperial	321		23	45,913			46,257
Kern	415	2		21,000	2		21,419
Kings	36			3,500			3,536
Lassen	248	19	49	37,650	91		38,057
Los Angeles	16,309	625	85	1,832	3	4	18,858
Madera	32						32
Marin	35						35
Mendocino	2	16					18
Merced	284	33		2,100	85		2,502
Modoc	19			8,382	8		8,409
Mono	54						54
Monterey	46	30					76
Napa		1	2		1		4
Nevada	2				1		3
Orange	399	2					401
Placer	2			12,064	357	42	12,465
Plumas	65						65
Riverside	32	81	11			127	251
Sacramento	134	1		5,150	160		5,445
San Benito		2					2
San Bernardino	995	26	5	19,583			20,609
San Diego	69	20		1,100			1,189
San Francisco	149	1					150
San Joaquin	480	72		14,343	726		15,621
San Luis Obispo	90						90
San Mateo	5	84					89
Santa Barbara	75	74			1		150
Santa Clara	236	12			1		249
Santa Cruz	10						10
Shasta	2						2
Sierra	24			1,600			1,624
Siskiyou	1,012	26		100	9	964	2,111
Solano	34	4			4	4	46
Sonoma	26			3,600	44	241	3,911
Stanislaus	919	84			65		1,068
Sutter	5	2					7
Tehama	47			2,200	1	1	2,249
Tulare	244						244
Tuolumne	2	2					4
Yolo	91			12,138	512	57	12,798
Yuba	36	6		10,900	75		11,017
Totals	25,300	1,356	176	226,234	2,875	5,595	261,536

TABLE No. 10

Miscellaneous Live Stock Inspections at Centralization Points During 1928

January	82,221	168,115	53,808	50		304,284
February	78,357	153,384	53,071	44		284,856
March	52,560	128,225	61,688	68		242,541
April	50,474	103,913	50,900		283	205,570
May	29,450	83,854	56,567		110	169,981
June	39,088	172,751	29,300			241,139
July	30,650	88,981	19,887			139,518
August	18,081	43,970	25,594			87,645
September	47,254	121,290	23,890			192,434
October	128,175	201,052	30,014			359,241
November	73,536	136,660	43,069			253,265
December	59,616	68,735	28,409			156,760
Totals	689,462	1,470,930	476,287	162	393	2,637,234

DIVISION OF MARKETS

BURKE H. CRITCHFIELD, Chief

FROM the standpoint of practical and direct value to producers, perhaps the most important activity of the Division of Markets during the past year has been its program toward the development of an adequate market information service for California farmers. As a result of this program, the farmers in this state no longer find it necessary to rely upon rumor or meager market information but may obtain from the Federal-State Marketing Service unbiased and reliable up-to-the-minute information, concerning crop and market conditions which influence the market for their products.

This activity, carried on under the title "Federal-State Marketing Service," is maintained by the Division, under a cooperative agreement with the Bureau of Agricultural Economics of the United States Department of Agriculture. During the past twelve months a program has been developed which makes available the most comprehensive and reliable market information service that the technically trained personnel and resources of these two organizations are able to furnish. This program has been made much more effective and comprehensive by the establishment of the short wave radio telegraph communicating system, inter-connecting the important producing and marketing areas in California.

REPORTS ON MARKET CONDITIONS IN CENTRALIZED MARKETS

This type of service is now well established. In general the service consists of current reports of daily, weekly, monthly and seasonal information by commodities to assist growers and shippers in carrying on their current marketing operations. The organization of this work includes market reporting offices in San Francisco and Los Angeles, with trained market reporters assembling and disseminating daily prices and other marketing facts covering these markets. This is supplemented with pertinent information on marketing conditions which comes over the federal leased wire system from eastern markets.

FRUIT AND VEGETABLE MARKET REPORTING SERVICE

The following types of reports are issued from the San Francisco and Los Angeles market reporting offices covering fruits and vegetables:

1. Daily carlot shipments from California and competing sections in the United States as reported by railroads and received by leased wire at the San Francisco office from the principal markets of the country.
2. Carlot receipts at principal receiving markets throughout the United States.
3. Carlot receipts at San Francisco and Los Angeles.
4. Prevailing conditions and market prices in leading markets.
5. Cold storage reports.
6. Annual summaries of the above.

These reports are sent to a large mailing list of growers and shippers throughout the western states and are copied generally by newspapers and press associations.

The principal commodities covered in this type of reports are:

Apples	Carrots	Grapes	Plums
Apricots	Cauliflower	Lemons	Potatoes
Artichokes	Celery	Lettuce	Raspberries
Asparagus	Cherries	Loganberries	Rhubarb
Avocadoes	Cucumbers	Onions	Spinach
Bananas	Currants	Oranges	Squash
Beans	Eggplant	Peaches	Strawberries
Blackberries	Figs	Pears	Sweet Potatoes
Cabbage	Gooseberries	Peas	Tomatoes
Cantaloupes	Grapefruit	Peppers	Watermelons

Previous to November, 1928, the Los Angeles fruit and vegetable market reporting service was conducted solely by the Federal Bureau of Agricultural Economics. A cooperative arrangement was inaugurated at that time which has greatly strengthened the fruit and vegetable reporting service for Southern California, the outstanding development under this new arrangement being the reporting of truck unloads and the very great increase in the amount of information from eastern markets furnished to the Los Angeles office for dissemination. This latter is transmitted from San Francisco to Los Angeles by the short wave radio telegraph system. The development by the Division of Markets of daily reports on receipts by truck and monthly summaries in which the receipts are analyzed and summarized by districts of origin has added greatly to the Los Angeles service. It has filled a long felt need in supplying growers and shippers with an adequate means of measuring the quantities of the various commodities arriving daily on the Los Angeles market. These reports should furnish a better basis for orderly marketing and should aid especially in preventing market gluts.

LIVE STOCK, MEAT AND WOOL REPORTING SERVICE

This service is conducted also in cooperation with the Federal Bureau of Agricultural Economics, with offices maintained at San Francisco and Los Angeles. It consists of daily market reports on cattle, hogs, sheep and wool, and includes reports of actual sales made and the market trend on the basis of federal grades, as well as a semiweekly market summary of prices and conditions in the eastern markets.

The following types of reports are issued:

1. Daily live stock report.
2. Daily western grass cattle report (part of year).
3. Weekly live stock report.
4. Weekly wool review.
5. Grain report.
6. Special reports such as outlook reports.

In addition to the above regular reports, some special reports are prepared for newspapers, trade associations and radio broadcasting stations.

MARKET REPORTING OF DAIRY AND POULTRY PRODUCTS

This project includes the market reporting and the grading service for these products in Los Angeles and San Francisco. Both types of

work are handled by the same personnel in cooperation with the Federal Bureau of Agricultural Economics under an agreement which started September 1, 1928. Previous to that time the program was carried out by an agreement with the California Bureau of Dairy Control.

The San Francisco office was opened June, 1918. In 1925, with the establishment of the San Francisco Mercantile Exchange, a cooperative agreement was entered into by the state and federal departments with the trade in San Francisco establishing federal grades on butter, eggs and cheese as the official trading grades, and the prices issued by the Federal-State Marketing Service as the official quotations of the San Francisco Mercantile Exchange.

The types of reports issued currently are:

1. Daily market report.
2. Weekly butter review.
3. Monthly export report.
4. Monthly cold storage report.
5. Monthly origin of receipts at Los Angeles and San Francisco.

SEASONAL MARKET REPORTING SERVICE IN PRODUCING CENTERS

Field market reporting stations have been maintained by the Federal Bureau of Agricultural Economics for a number of years in Fresno, the center of the grape shipping district, in El Centro, the center of the Imperial Valley lettuce shipping, and in Brawley, where the Imperial Valley cantaloupe shipping and marketing centers. These field stations are in charge of trained field reporters who issue daily bulletins covering market prices and activity in eastern and other consuming markets and quote an f.o.b. price to assist shippers and growers in their marketing operations. In these projects the Division of Markets is actively participating.

The short wave radio telegraph will play an important part in these reporting stations as it will give them direct up-to-the-minute communication with San Francisco, Los Angeles, other producing centers in California, and with eastern markets through connection with the federal leased wire system. The first field station with short wave radio equipment was opened at Salinas in October, 1928, where headquarters were maintained for reporting the Salinas-Watsonville fall lettuce marketing. The radio service was highly satisfactory and dependable, being at the same time unique and interest creating.

Reports summarizing local and eastern market information on lettuce were released in mimeograph form daily by the reporter in charge. These reports were distributed by motorcycle to lettuce packing sheds in Salinas, Watsonville and other surrounding points within a short time after being prepared. A summary of the Salinas-Watsonville marketing situation was issued by the Division of Markets and is available for distribution.

Previous to the establishment of this service the Salinas Chamber of Commerce distributed a daily bulletin during several seasons. These bulletins consisted of wire reports on several markets forwarded from the San Francisco reporting office.

At the completion of the 1928 fall reporting service at Salinas, an arrangement was made between growers and shippers of lettuce and

other vegetable crops, beans and apples and the California Division of Markets to establish a year-round field reporting service for the Salinas-Watsonville district. A trained market reporter and a short wave radio station are to be maintained there during the entire year under this arrangement.

During the active shipping season for Tokays, a market report was forwarded by the Division of Markets to Lodi and issued daily. This service was well received by growers and shippers.

CURRENT MARKET INFORMATION SERVICE ON SELECTED COMMODITIES

For a great many farm commodities in California there are no centralized markets and there is but meager market information. For many commodities there is no central trading place, nor is sufficient trading focused at any particular point as a market center for the commodity such as is present in the live stock markets in San Francisco and Los Angeles or in the dairy and poultry exchanges. In the case of prunes or dried fruits in general, vegetables, grains, beans, and many fruits, such a market center or centralization of trading is absent. Furnishing an effective market information service to such industries was one of the problems which was given major consideration in developing the new marketing program for California in 1928, and such a program was inaugurated.

This type of service is best illustrated by the series of prune market information bulletins issued during 1928 in response to requests from prune growers and leaders in that industry. Previous to this time the independent prune grower had no means of determining the value of his product and had to rely on the rumors current and the offers of the trade. The new service gave the grower the current situation in the foreign markets, conditions in foreign and domestic producing areas, and current reports of the prices and activity prevailing in the different prune growing sections of California and the northwest. Such reports require a thorough statistical background, trade contacts and extensive field service to make them effective as there is no centralization of marketing activity. The cooperation of the foreign service of the Federal Bureau of Agricultural Economics enabled the reports to be rounded out from a world standpoint. The Federal Bureau has responded generously in expanding the reports to meet California needs.

Inasmuch as there is no centralized market for beans, turkeys, grain, dried fruits, nuts and similar classes of products, a great deal of field work, field reporting, and correspondence by wire and mail is involved in obtaining up-to-the-minute facts regarding prices and movement and in coordinating the material obtained.

In this type of marketing information service also the short wave radio will play an increasingly important part. Through the field stations to be maintained during the active marketing seasons, there will be gathered hourly and daily the marketing activity in the various localities of the state. At the fields, portable units of the wireless radio network will be set up. Reports on conditions will be collected and sent to the central office and in turn a complete report of the whole situation will be sent to the local units for dissemination. Growers will be enabled to keep in daily contact with every market for the commodities they produce.

DISSEMINATION OF MARKET INFORMATION

Rapid dissemination of this information is of the greatest importance and is accomplished primarily by means of the short wave radio telegraph network, the leased wire system of the Federal Department of Agriculture and by radio voice broadcasting. When the various reports are prepared they are transmitted immediately by radio telegraph to branch offices for dissemination. These reports are posted as bulletins, mimeographed and mailed to those interested, prepared for newspaper release and broadcast over several large radio stations.

Market information is broadcast at regular fixed hours each day over KQW, the Farm Bureau broadcasting station at San Jose. These broadcasts are made by remote control from the studios in the Department of Agriculture offices at San Francisco and Sacramento at 12.30, 6.10 and 6.30 p.m. each day.

SPECIAL MARKET INFORMATION ON SELECTED COMMODITIES

In order to meet unsatisfactory marketing conditions which from time to time confront different agricultural industries in California, both as to a factual background for a program of marketing improvement and to furnish a background for an adequate market information service, the program inaugurated in 1928 by the Division of Markets provided a special type of market information. The functions of the service in this connection are as follows:

A. To determine the facts regarding the market situation, the market outlets and the market outlook.

B. To analyze the facts as they apply to the program in California.

C. To present this information to the industry or group involved.

D. Upon requests of further assistance, to counsel and advise with the group regarding sound programs for improvement in marketing based upon the facts disclosed in the study.

In the event that any research is necessary in connection with this type of service, an understanding with the College of Agriculture of the University of California provides for the closest coordination of the efforts of the university, the Federal Bureau of Agricultural Economics and the California Division of Markets in effecting such research. In the event problems of this kind are undertaken, it is recognized that considerable work in gathering market information must of necessity be carried on in markets outside of California where the products are consumed. In the gathering of such market information, consideration is given to:

A. Methods of distribution.

B. Habits of consumers regarding the product.

C. Attitudes of the trade towards the product.

D. Annual and seasonal requirements of different markets here and abroad and rate of movement to market so that producers may better understand the merchandising problems involved in the marketing.

E. General market conditions in the domestic and foreign markets as they relate to prices consumers can pay.

F. Possibilities of influencing consumption and increasing demand and methods for so doing.

G. Changes needed in the grades and standards to better marketing conditions and the formulation of standards.

H. Marketing practices, methods, and machinery.

I. Other considerations that will help to throw a light on the marketing problems confronting the industry.

PRUNES

During 1928 considerable assistance was given the prune industry and the canning peach industry of the state along the above described lines. The Division secured the cooperation of the Federal Bureau of Agricultural Economics and the University of California in making a study of certain phases of the prune industry. The chief feature of this work was a study of growers' attitude toward their marketing organizations and the gathering of facts regarding the consumption and distribution of prunes. The latter phase was still in process of completion when the year ended.

CANNING PEACHES

The service to the canning peach industry included a very comprehensive survey of the markets for canning peaches, including the attitude of the trade and of consumers towards canned peaches, and their use and preferences; competition of canned peaches and other canned, dried and fresh fruits, together with a comprehensive study of their distribution and marketing. This work was started in April, 1928, and the field work was completed by the end of the year. It is anticipated that a report of this market information will be ready for distribution early in the spring of 1929, and that it will furnish the canning peach industry with a background of fact with which the industry leaders may more intelligently face their marketing problems.

RICE

The Division of Markets cooperated extensively with the Federal Bureau of Agricultural Economics in certain phases of a study of the California rice industry. Report of this work is being prepared by the federal bureau and it is anticipated will be distributed early in 1929.

CANNING PEACH PRICES

The Division of Markets was represented in a series of conferences, lasting from April, 1927, to October, 1928, between the various factors in the canning peach industry, including packers and growers, in connection with the marketing problem of 1928. A great deal of information was secured for the conference, including a survey of stocks of canned fruits in the hands of various marketing factors as of June 1, 1928. In this connection, the cooperation of the Federal Bureau of Agricultural Economics was secured in determining the probable factors that should be considered in connection with canning peach values and the cooperation of the United States Department of Commerce was secured in making a survey of stocks in the hands of wholesalers and chain stores.

The function of the California Division of Markets in this particular service was to furnish information to the various committees, to meet

with them and to counsel on the application of the information to the problem in hand.

PRODUCE DEALERS ADMINISTRATION

The Division of Markets is vested with the administration of the Produce Dealers Act, designed to protect the growers of California farm products who market their commodities on a consignment or agency basis. This law became effective July 31, 1927, and provided that any dealer handling California farm products shall be licensed by and bonded to the State of California in the sum of $5000 to insure compliance with the provisions of this act. The law was practically inoperative during 1927, however, due to the fact that the constitutionality of the act was being tested in the courts. The decision confirming its constitutionality was rendered by the superior court in San Francisco on December 31, 1927.

During the calendar year 1928, licenses were issued to 637 produce dealers as compared with 263 in 1927.

Of the 203 complaints received by the Division during 1928, the great majority indicated a general dissatisfaction with prices received, 32 covered failure to pay because of bankruptcy of the dealer, and 13 covered failure to pay because of the death of the dealer. Of the claims investigated, recoveries were made in 62 cases involving a total of $8,525.63.

The policy of the Division has been to adopt a vigorous program to bring about licensing and bonding of dealers and to revoke licenses where dealers are shown to be dishonest or acting in bad faith.

An educational program was inaugurated showing how shippers can aid greatly in the enforcement of the Produce Dealers Act by retaining a record of all the facts regarding each shipment, including record of weights and grade with a copy of their letter or transmittal. In addition it was shown how they might also render a real service to themselves by selling only to licensed dealers and by asking to see the license card of each buyer who approaches them soliciting consignment business.

Considerable time was spent on hearings in connection with the dairy products exchange administration, a function handled by the Division of Markets. In addition to the hearings, the Division cooperated actively with the Federal Bureau in a study of the operation of the San Francisco Mercantile Exchange, the report of which is expected soon. A member of the Division represents the Department at the meeting of the directors of the San Francisco Exchange.

THE STATE FISH EXCHANGE

E. L. Sisson, Secretary

DURING the past twelve months the attention of the department has been directed principally to a constructive program for solving the marketing problems connected with the fresh fish business in California, and to laying foundations for a sound conservative program designed to protect and insure a continuance of the present fresh fish supply, and, if possible, augment the same.

The fishing industry presents more angles than the much discussed European situation, and almost as many intricacies and delicate situations as a national political convention. Because of the diversity of its methods, the perishable nature of its products, natural influences, the large preponderance of foreigners engaged in the business, and lastly, and most serious, the seasonal feature of its supply, the fishing industry is ever seething with problems. Notwithstanding the difficulties presented, a serious effort has been made during the last year to solve some of the problems and correct the abuses.

In the past, the fish exchange was considerably interfered with in the proper enforcement of the law through law suits. The courts in every case have sustained the legality and powers conferred in the State Fish Exchange Act. The court decisions have established for all time the right of the state to regulate the catching, sale and distribution of fish in the interests of the people, and also established the right of the legislature to provide a system for fixing the wholesale and retail price for the sale of fresh fish, allowing a reasonable compensation or profit to those engaged in catching or selling fresh fish.

During 1928 the exchange has not been required to fix prices on fresh fish, as nothing has occurred to interfere with the regular law of supply and demand. It is the opinion of the writer that in most cases it is not desirable to undertake to fix prices on fresh fish unless the law of supply and demand is interfered with in some way, or an attempt is made to create a monopoly and unduly raise prices of fresh fish to the consumer. It is a fortunate thing that the people of the state established, through the State Fish Exchange, the right of control over this great food supply before a monopoly control was brought about by a combination of large capital.

Many people believe that in order to supply the market with the needed quantities of fish, all that is necessary is for the fishing boats to put to sea, drop their nets and bring in a shipload, and that this can be done at a nominal expense.

As a matter of fact, this is far from the true situation. "Fishermen's luck" is as important a factor to the fisherman as to the sportsman; in fact more so, as the fisherman has much more at stake, with a heavy investment in boats, nets, etc., and always the chance of losing a net that may have cost several hundred dollars, and possibly due to an accident or storm, lose a ship. The general public also believes that the ocean is teeming with fish ready to be caught; these beliefs are prevalent due to a lack of knowledge of natural history.

Through the educational efforts of the exchange, largely by means of the cookbook, the consuming public has become more familiar with

the many varieties of delicious fish that formerly were unnoticed. Consumers heretofore confined themselves largely to three or four varieties, such as salmon, halibut and fillet of sole, ignoring other equally good varieties. The cookbook referred to was published in 1928 and is entitled "Five hundred ways to cook California sea foods." The printing was done by the State Printing Office at Sacramento, the first edition appearing in March, 1928. Thirty thousand copies have been printed and distributed this year, and it is our hope to distribute a like number this coming year. No charge is made for the books. However, if sent by mail four cents postage is required. The department has been highly complimented for this book.

Fish prices are subject to greater variations than most any other food product. This is caused by the varying quantities from day to day, and being quickly perishable, rapid fluctuations in price occur. Demand for fish can be reasonably well estimated, but the supply cannot. For fishermen to be assured a catch before casting their nets is impossible because of the element so well known as "fishermen's luck." If the catch is small, the actual cost per pound to the fishermen is higher than with a larger catch; and the cost price is naturally affected in the price paid by the consumer.

As an illustration of this: At San Francisco, five sets of trawlers landed in one day only five thousand pounds of soles, sandabs, flounders, etc. The actual cost of this day's fishing amounted to over $1,000, or a cost per pound of twenty cents landed.

In order to keep the fishermen fishing, it is necessary that they receive reasonable compensation and living returns. This will be found to answer the question often asked as to why the prices are so high on certain varieties, either out of season or as a result of a small catch. If it were possible to provide an assured supply from day to day, violent fluctuations of prices would not occur. In addition to other factors affecting the supply, such as weather, storms, etc., fish is a seasonable food. Some months certain varieties are plentiful, and other months other varieties, while some months certain varieties are unobtainable at any price. A majority of the complaints of high retail prices of diffierent varieties are made when those varieties are out of season, or the catch is small. Fish prices more sensitively reflect the variable feature of supply than almost any other food product.

When there is a surplus catch of fish on hand, the reduction of the price itself will not move it for the reason that the consumers will not know immediately that the prices have been reduced, and before they find out about the price, the fish have very likely spoiled. This could be largely prevented and the fish marketed in an orderly manner at a price profitable to those engaged in the industry, and at a great saving in price to the consumer, if the dealers had ample up-to-date cold storage facilities and machines and equipment for filleting and properly packing the fish for market. The fish exchange is now working, in cooperation with the fishing industry, on a plan to supply the necessary cold storage and marketing facilities for marketing the fish of California in an orderly manner. We have found this a big undertaking, but the results to be accomplished are well worth the effort.

As soon as the dealers have perfected their facilities for serving the consumer according to modern marketing methods, the fish exchange plans to assist in creating an increased demand for fresh fish products by advertising in newspapers and other publicity organs. Individually neither the wholesale companies nor retail dealers would find it practicable to advertise, because, without the data we obtain, they would not know accurately the amount of surplus existing, and the cost to the individual firm would be prohibitive in comparison to the business done.

As the exchange is able to determine with reasonable accuracy the available supply each day, and at the same time notify the public of a surplus, a service is rendered the industry and the consumer.

As the administrative and all other expenses of the state fish exchange are paid from licenses collected from the fresh fish industry, there is no charge against money collected from the people of the state in taxes.

Much of our fish supply, such as salmon, halibut and Mexican sea bass, is shipped from Washington, Oregon and Mexican waters. This fish must carry transportation charges, boxing, icing and wastage, all of which adds greatly to the price. In spite of the price, these imported varieties are in large demand by local consumers. The Mexican sea bass is not an important competing fish as it is largely in supply when the popular local varieties are not abundant.

There was a time when sales of fish in California were confined almost entirely to Friday. By a campaign of education this limited day purchase has been largely eliminated. Material benefit has resulted to both fishermen and dealers as well as consumers through the more constant sale of fish. By limiting purchases to Friday, consumers create one of the most vital contributing factors to high fresh fish prices and waste. The reason for this is not difficult to see. With a "one-day-in-the-week" business, the expense carried through the week must be met out of the sales on Friday. During past years, retail fish sales on other days than Friday have been nominal, most often resulting in a deficit for the dealer on the sales on those days. For the retailer to raise prices to a profitable margin on such days was impossible, since such action would have still further discouraged sale. What the dealers did was to charge more on Friday to recompense for losses sustained on other days.

Realizing that great advances in the production and merchandising of fish were taking place in important fishing centers in the east, the exchange last September sent Mr. W. R. Smith on a survey trip to secure first hand information concerning the quick freezing and production methods applied to the fillet business. Mr. Smith visited Washington, D. C., New York, Boston and other eastern fishing centers. Much valuable data was collected which is available to the fishing interests of California.

California has fallen far behind eastern and northern fishing centers in methods of handling and selling fresh fish products.

The major difficulties here are, first, lack of modern refrigeration plants; second, lack of knowledge on the part of the industry of markets which could be reached if modern and improved practices were put into effect.

Few people not connected with the fishing industry can realize the importance of refrigeration in the distribution of fresh fish. Refrigeration is the only method by which fish can be kept in their original condition for long distance transportation or for storage over long periods.

Supply and demand for fish are highly irregular. Catches of nearly every species are seasonal, and even in seasons of abundance, weather conditions affect the catch from day to day. With production ranging from a glut to a scarcity, and a market whose demand fluctuates on account of religious and racial customs, the need for refrigeration to take care of the oversupply is obvious.

Refrigeration in this state, or at least, refrigeration as applied to the fishing industry, is not up to modern standards and the plants are not adequate. The freezing here, while efficient for many products, is not entirely satisfactory with fish, as the temperatures possible to attain are not low enough. Slow freezing at relatively high temperatures ruptures the cellular structure of fish by expansion of the liquid gel walled up in them. When defrosted, they lose these liquids, with consequent loss of flavor and appearance. As a broad statement, it may be said that rapid freezing at low temperatures prevents the escape of cell juices, so that the first essential in the proper handling and refrigeration of fish are freezers that can attain temperatures from 20 degrees to 50 degrees lower than is possible in our present plants. Such freezers are available on the Atlantic coast; some are air freezers, some brine freezers, and some use has also been made of carbon dioxide gas or dry ice, and lately, we have read where fourteen carloads of fish were sent into Texas in iceless refrigerator cars under a system devised by the Safety Car Heating and Lighting Company of New York City.

Rapid freezing, however, is only the initial step for solving the problem of presenting to the consumer frozen fish that would be equal in quality to fresh fish. Frozen fish must of necessity be held in storage for long periods. Even when subjected to rapid freezing as described above, serious deterioration in quality can take place so it is necessary not only to provide plants which will freeze rapidly but also to secure information as to the exact temperatures used in freezing different species of fish and the exact temperatures at which they must be held to get the best results.

In conjunction with advanced refrigeration methods, the eastern fishing centers are making use of mechanical devices and machinery to a great extent in connection with the handling, cleaning and filleting of their fish. While great strides have been made in the east in the refrigeration of fish and use of machinery in skinning and filleting, these processes have all been developed to fit the species caught in eastern waters, and while we could use all the basic ideas involved, both the freezing processes and machinery would have to be adapted to the species caught in our waters.

Adoption of improved methods in handling their fish would not only enable the fish dealers of our state to offer the consumer a greatly improved product, but would in a large measure, help solve some of their marketing problems.

One problem we have already mentioned in connection with refrigeration is that of being able to carry over a large catch so that the price would not be too greatly depressed when the catch is large or unnat-

urally higher when the catch is small. The confidence engendered by staple prices would be reflected in increased buying. A modern practice is to market fish in the form of fillets and steaks wrapped in sanitary packages, free from bones, skin, etc.

Those eastern centers using modern refrigeration methods and machinery are selling most of their fish in this form; in fact, wrapped haddock fillets are shipped from Massachusetts to California and finding a ready market, especially in our interior towns. With a production such as this, not only could California dealers greatly enhance their business in this state, but they could also invade the middle and southwest. This territory is far from any seaboard and is a great potential market. At present, little or no California fish is sent into this territory, due primarily to the fact that we are unable to get our fish to this territory in salable condition under present distribution methods.

The fish produced under modern conditions and wrapped can be labeled, allowing the producer to advertise his product.

The center of the package fish industry is Portland, Me., Boston, Gloucester and Provincetown, Mass., and New York City. These ports in 1926 produced over 17,000,000 pounds of fresh and frozen fish and this production is growing by leaps and bounds.

When a thorough knowledge is gained of the methods and processes followed in the above centers, it is proposed that we secure suitable machinery for the filleting and cleaning of fish, and also get the use of an adequate freezer, both in San Francisco and in San Pedro, and working in conjunction with the wholesalers in both ports, operate each plant so installed as a model freezing and production plant.. Careful records could be made of cost of producing fillets of the different species of local fish, cost of freezing and holding. All fish produced from either of the plants could be sold through the regular channels.

The ocean and the bays marking the western boundary line of California and inland lakes and streams carry many choice varieties of fish, but unfortunately, due to wasteful fishing methods, some of the choicest varieties that in former years were in great abundance, such as salmon and albacore, are becoming very scarce. Conservation of our fish must receive careful attention if we are not to suffer what may be almost an entire loss of supply in the near future. Some varieties of fish, such as salmon and albacore, are decreasing in supply so rapidly that there is a possibility they may disappear entirely in commercial quantities in the very near future unless something is done to conserve the supply.

Some are of the opinion that the albacore is a migratory fish and changes its home, but those holding this opinion appear to be in the minority. The generally accepted theory is that they have been caught in too large quantities and at improper seasons, such as spawning time, and that their natural food supply has been diminished by catching and reducing to fertilizer too large an amount of sardines and other small fish which are the natural food of the albacore.

Some claim, with good grounds for their opinion, that the sea lions destroy vast quantities of our best food fish. Little, if anything, can be said in defense of the sea lion, as he appears to be a useless animal.

The proper methods to adopt for the conservation of our food fish is to some extent debatable, but the proper method *can be ascertained*

and must be adopted and carried out without delay, if our fish supply is to be maintained. Our growing population, the increasing scarcity of other meat supplies, and the necessity of maintaining a valuable industry amounting to over $30,000,000 per annum, demands that we lose no time in acting on this important matter. In order to carry out any approved plan of conservation, additional powers must be granted to the State Fish Exchange and to the Fish and Game Commission.

DIVISION OF WEIGHTS AND MEASURES

J. S. Casey, Chief.

THE PAST year has brought about further increases in the personnel of local weights and measures departments, the entire forces in the state at the present time totaling 132 officials, comprising the state division with 9 members, the county departments with 108 officials, and the bedding enforcement division with 15.

A splendid morale prevails throughout the entire organization, and everything possible is being done for the protection of our citizens in their trade relations with each other.

The past season this office has been engaged in inspecting and testing the weighing and measuring equipment used in pharmacies throughout the state. Unfortunately the division has not sufficient men to make this test annually, with the result that sometimes several years elapse before attention can be given to the matter.

This work is of a scientific nature and can only be properly performed by officials who have made a thorough study of drug weight testing. Extreme accuracy is necessary, as the major portion of the equipment in question is used in the compounding of prescriptions.

GASOLINE PUMPS

A very perceptible and growing tendency on the part of motorists to favor the visible type of gasoline pump has resulted in the installation of numerous devices of this character. Practically every company manufacturing gasoline pumps has felt the necessity of placing on the market "visible" apparatus, and it is very likely that in a short space of time this type of equipment will predominate.

The various types of these devices require careful attention on the part of the state department, to insure that in their construction no features are employed that will act as an economic detriment to purchasers of gasoline. It has been the practice of the department since the visible pumps have appeared in this state to carefully inspect the various features of the construction, and no pump has been permitted in use which did not receive our approval of type.

In this work we have received every cooperation from the manufacturers, who, we believe, are doing everything in their power to place on the market devices that will serve all practical purposes, and at the same time insure a square deal to the purchasers of gasoline. In the construction of their devices they have been handicapped in attempting to coordinate fire underwriter and weights and measures requirements, which sometimes conflict. For instance, the fire underwriter requirements state that a by-pass shall be used to reduce the fire risk on such devices. Weights and measures officials prefer that such a feature not exist in pump construction, as it affords a ready means for the operator of the pump to return liquid to his underground tank, while delivering gasoline to a purchaser, unless by some means it is made possible that these by-passes are automatically locked.

The gasoline business today is one of our most important activities, there being not less than 32,000 pumps in the state, all of which require

the attention of weights and measures officials from time to time to assure their accuracy.

If the purchasing public would do its part in observing the practice of operators of these devices, considerable saving in dollars and cents would not only result, but a policy of honesty would be built up in the trade dispensing motor fuel.

NET CONTAINER ACT

The inspection of food in package form is carried on mainly with the purpose in view of keeping a close check on the observance of requirements as specified in the Net Weight Container Act. In this we are favored with the backing and full cooperation of the federal government, which has a law on the statutes similar to that in effect in this state. New concerns are continually appearing which put up this or that article in package form, and, in many instances, neglect to declare the quantity of contents on the package as our law provides. A direct request for compliance on the part of the firms at fault is usually complied with; where no effort to meet our requirements is manifested we prosecute, or if out of our jurisdiction, as in interstate cases, the matter is placed in the hands of federal authorities for attention.

TEST OF EQUIPMENT AT STATE INSTITUTIONS

The regular yearly test of the weighing and measuring equipment used at state institutions was completed satisfactorily. Conditions in general were found good, and recommendations for replacement or repair were made in cases where the equipment was found in such shape as to warrant action. Our inspectors, in making tests, make all necessary adjustments to bring weighing apparatus up to the required standard of accuracy.

PROSECUTIONS

While our work entails prosecutions, it is not the policy of the department to persecute merchants, and our efforts at all times are mainly directed toward a strict enforcement of the weights and measures statutes along the lines of fairness, justice and helpfulness. Where drastic action in a legal sense is necessary, it is employed without hesitation.

CONFISCATIONS

There are features included which merit special comment. First is the large number of pieces of weighing and measuring equipment it was found necessary to condemn and confiscate during the year. While difficult to estimate the loss in dollars and cents to the consumer were this equipment allowed to remain in use and were there no regulating power to eliminate such false devices, we can without a very great stretch of the imagination realize that the economic loss would be tremendous.

The particular condition with relation to incorrect weighing and measuring devices is undoubtedly influenced to a large extent by the fact that certain manufacturers in an endeavor to meet competition, where weighing machines are concerned, have been placing upon the market cheaply constructed scales which do not stand up in service.

True, their product can be purchased by merchants at considerably less than equipment of the better type, nevertheless, it is really false economy on the part of merchants, as condemnation of the equipment frequently becomes necessary after very short periods of use.

The number of pieces of equipment condemned and confiscated during the past year was above the usual average. This does not necessarily imply that the equipment so treated was purposely made fraudulent, for while there was a goodly number in this class, the majority had simply outlived their usefulness.

THE WEIGHMASTER ACT

Since its adoption, this law has been a complete success, regulating all matters pertaining to public weighing, and assuring a greater degree of accuracy than existed prior to its passage. The penalty is too heavy for anyone to take chances with violations. The certification and appointment of weighmasters is under the jurisdiction of this department. Regular application must be submitted by those desiring appointment. Our application form is in the nature of a questionnaire, and from it we judged the merits of the applicant, and whether or not he or she is considered a fit person to perform this important work. Requests for renewal have been coming in satisfactorily, but local sealers have been instructed to check up on all weighmasters operating, to see that they have proper credentials. To date, this department has certified 1670 weighmasters in California.

During the year five public weighmasters' licenses were revoked, and bonds in each case amounting to $1,000 ordered forfeited, on account of fraudulent issuing of weight certificates and deliberate incorrect weighing.

The testing of heavy capacity scales throughout the state has reached a point where it is practically beyond the power of local officials, with their meager complement of weights and equipment, properly to carry on. State owned and operated equipment has long been advocated, as county officials admit their inability to cope with the conditions brought about by the installation of the very heavy type of wagon and truck scales now in use. The testing of five-ton and ten-ton scales was an easy matter, but with heavy duty scales increased to twenty-five and thirty tons, which are the sizes now most commonly installed, a comparatively heavy class of testing equipment must be employed. We have built up our complement of weights for this purpose, and have purchased a truck for transporting this equipment.

CALIFORNIA BEDDING LAWS

During the 1927 session of the legislature there was passed the Upholstered Furniture Law and Mattress Regulation Inspection Act. The enforcement work has been carried out successfully by the Division of Weights and Measures through the determined honesty of all inspectors in explaining the laws, and a spirit of loyalty in the territory assigned to them throughout the State of California. Both laws carry practically the same principles, viz:

1. The expediting of enforcement work.
2. Accurate statement on labels as to the true character of the concealed materials.

3. The public health is better safeguarded by rigid enforcement of the laws, as it prevents the use of contaminated and second-hand filling materials.

4. The health of workers coming in close contact with filling materials is protected by the elimination of contaminated materials.

5. Both the manufacturer and retail divisions of the furniture and mattress industry are benefited by higher standards and better service to the public.

Licenses issued in California:

Mattress manufacturers	396
Mattress renovators	153
Mattress retailers	3,255
Furniture manufacturers	501
Furniture repairers	314
Furniture retailers	1,795
Grand total	6,413

STERILIZATION

All second-hand mattresses, upholstered furniture, feather pillows, comforters and cushions, or contaminated materials used for the filling of these commodities must be sterilized before being offered for sale.

Second-hand articles requiring sterilization consist of:

Quilted pads, bunk quilts, comforters, mattresses, mattress pads, cushions, pillows, davenports, duofolds, couches, lounges, box springs, Morris chairs, upholstered baby buggies, large settees or any other upholstered article that could be used for sleeping purposes.

There are now installed and operating under state permit fifty-eight sterilizing cabinets.

DIVISION OF LAND SETTLEMENT

CHAS. W. CLEARY, Chief

SINCE the report of this division for 1927 much time and investigation have been devoted to an attempt to ascertain the real facts with respect to conditions on the land settlement colonies at Delhi and Durham and to work out a plan for readjustment of land settlement affairs on a basis fair both to the state and to the settlers. It was apparent at the time of the last report that matters could not go on without definite readjustment.

Early in 1928 a special investigator, well acquainted with Butte County conditions, spent some time in an investigation at Durham colony, where agitation was acute, meeting individual settlers and groups of settlers and discussing with them their problems. At the close of his investigation he filed, with the division of land settlement, an extended report in which he recommended that the state make a just, fair and reasonable adjustment of Durham colony affairs and as soon as conditions would permit discontinue the administration of the colony. A survey and investigation of drainage and irrigation problems at Durham colony also was made with a view to determining the needs and possibilities along that line.

Due to negotiations between the settlers and the administration all rescission suits filed or contemplated by settlers have been held in abeyance but special suits by settlers against the state may shortly come to trial.

At both Delhi and Durham a reappraisal of every unit of property is being made by qualified appraisers with the purpose in mind of determining the present value of all the properties in each colony.

Every effort has been made to find the true conditions in each colony in order that a proper foundation for a fair and equitable readjustment may be had. It is hoped and expected that shortly a plan will be developed which will accomplish a fair readjustment and permit the state, within a reasonable length of time, to withdraw from the administration of the colonies. The departments of finance and public works are cooperating with the department of agriculture in working out such a plan.

Legislation designed to make the readjustment and liquidation of land settlement affairs legally possible has been prepared and will be presented to the legislature of 1929 for consideration. An emergency appropriation of $185,000 will be asked at the first session of the 1929 legislature to settle in full the state's obligation to Stanford University on contract of purchase covering lands in Durham. This obligation amounts to over $208,000 on February 1, 1929, and settlement at that time will save the state some $23,000.*

As would be expected under a condition of impending readjustment and at a time when returns from agricultural operations are generally short, collections from settlers have not been very heavy and available operating capital at both colonies has been rapidly depleted.

*This appropriation was made by the Legislature and full settlement with Stanford University has been made.

In presenting an audit of land settlement accounts as of November 30, 1928, the auditor for the Department of Finance says with reference to Delhi:

Of the 8348 acres comprising this settlement, 3863 acres or 46 per cent remain unsold; 97 acres or 1 per cent have been disposed of for cash; 4388 acres or 53 per cent have been sold on contract.

On November 30, 1928, the settlers owed the State of California the sum of $1,316,064.65 of which amount $92,031.36 was delinquent. It is well to consider in this connection that the delinquencies have accrued during the forty months that have elapsed since July, 1925, at which time the colonists started out with a clean slate, after the adjustment.

There are cash assets to the amount of $23,800.12 available for operation, which will not in the light of past experience last longer than six months.

And with respect to Durham the auditor says:

Of the 6240 acres comprising this settlement, 866 acres or 14 per cent remain unsold; 296 acres or 5 per cent have been disposed of for cash or donated for community purposes; 5078 acres or 81 per cent have been sold on contract.

It is well to consider that the delinquencies in amount $112,780.54 which are part of the total settlers' obligations to the state, in amount $538,637.47, have accrued in the 10 years elapsed since June, 1918, the date of establishment of the colony.

There are $12,271.37 in cash assets available for operations, which will not in the light of past experience last longer than six months.

The settlers owe, in addition, $62,068.44 to the Federal Farm Bank.

With respect to the investment of the state in land settlement the auditor says:

The state of California has expended to date in land settlement activities $3,200,005.43, of which amount $2,859,881.05 represents net appropriations and $340,124.38 unpaid interest. Due to legislative interest remission in 1925 and amount appropriated strictly for administrative purposes, $633,214.38, is not recoverable. Of the balance due from the Land Settlement Division, in amount $2,566,791.05, Delhi is responsible for $2,148,817.55 and Durham for $417,973.50.

Financial statements from auditor's report follow:

STATEMENT OF FINANCIAL STATUS

November 30, 1928

DELHI

Assets

Cash		$23,800 12
In state treasury	$19,800 12	
Revolving	4,000 00	
Matured settlers' obligations		92,031 36
Land contracts	19,200 79	
Improvement contracts	52,210 09	
Special notes receivable	3,836 25	
Accounts receivable general	13,340 58	
Accounts receivable rentals	3,443 65	
Unmatured settlers' obligations		1,224,033 29
Land contracts	799,123 84	
Improvement contracts	419,579 97	
Special notes receivable	5,329 48	
Accounts receivable, non-settlers		1,235 31
General	41 20	
Rentals	1,194 11	
Stores		24,791 90
Equipment		4,173 21
Unsold properties		991,046 25
Land	729,517 38	
Improvements	247,024 08	
In process of reversion	14,504 79	
Federal Farm Bank		16,116 47
Capital stock	15,755 00	
Bonds	360 00	
Deposit certificates	1 47	
Interdepartmental items		12,078 45
Accrued assets unposted		7,750 00
Deficit		45,813 86
Totals		$2,442,870 22

Liabilities

State of California		$2,144,967 55
Recoverable appropriations	$2,125,519 48	
Interest	19,448 07	
Federal Farm Bank		294,603 21
Deposits returnable		3,299 46
Totals		$2,442,870 22

DURHAM

Assets

Cash		$12,271 37
In state treasury	$10,271 37	
Revolving	2,000 00	
Matured settlers' obligations		112,780 54
Land contracts	101,621 47	
Improvement contracts	2,266 90	
Special notes receivable	7,607 65	
Accounts receivable general	1,063 32	
Accounts receivable rentals	221 20	
Unmatured settlers' obligations		425,856 93
Land contracts	357,502 20	
Improvement contracts	17,828 74	
Special notes receivable	50,525 99	
Stores		320 62
Equipment		1,808 55
Unsold properties		124,100 73
Land	100,982 85	
Improvements	23,117 88	
Federal Farm Bank		365 00
Capital stock	365 00	
Accrued assets unposted		11,000 00
Totals		$688,503 74

Liabilities

Stanford University		$206,395 17
State of California		417,973 50
Recoverable appropriations	374,480 52	
Interest	43,492 98	
Federal Farm Bank		6,181 38
Interdepartmental items		12,078 45
Reserve for future expenditures		45,875 24
Totals		$688,503 74

DELHI AND DURHAM COMBINED

Assets

Cash		$36,071 49
In state treasury	$30,071 49	
Revolving	6,000 00	
Matured settlers' obligations		204,811 90
Land contracts	120,822 26	
Improvement contracts	54,476 99	
Special notes receivable	11,443 90	
Accounts receivable general	14,403 90	
Accounts receivable rentals	3,664 85	
Unmatured settlers' obligations		1,649,890 22
Land contracts	1,156,626 04	
Improvement contracts	437,408 71	
Special notes receivable	55,855 47	
Accounts receivable, non-settlers		1,235 31
General	41 20	
Rentals	1,194 11	
Stores		25,112 52
Equipment		5,981 76
Unsold property		1,115,146 98
Land	830,500 23	
Improvements	270,141 96	
In process of reversion	14,504 79	
Federal Farm Bank		16,481 47
Capital stock	16,120 00	
Bonds	360 00	
Deposit certificates	1 47	
Interdepartmental items		12,078 45
Accrued assets unposted		18,750 00
Deficit		45,813 86
Totals		$3,131,373 96

Liabilities

Stanford University		$206,395 17
State of California		2,562,941 05
Recoverable appropriations	2,500,000 00	
Interest	62,941 05	
Federal Farm Bank		300,784 59
Deposits returnable		3,299 46
Interdepartmental items		12,078 45
Reserve for future expenditures		45,875 24
Totals		$3,131,373 96

STATEMENT OF INCOME AND EXPENDITURES

June 1, 1917, to November 30, 1928.

(This is from the inception of State Land Settlement.)

	Land Settlement Division	*Durham*	*Delhi*
Developmental	$1,453,154 72	$307,336 81	$1,145,817 91
Administrative	660,641 79	293,551 29	367,090 50
Operative	197,640 38	97,233 00	100,407 38
Total income	$2,311,436 89	$698,121 10	$1,613,315 79
Deficit			45,813 86
Developmental	$1,212,263 30	$191,025 98	$1,021,237 32
*Administrative	837,279 38	419,456 91	417,822 47
Operative	261,832 83	41,762 97	220,069 86
Total expenditures	$2,311,375 51	$652,245 86	$1,659,129 65

* Figures given as administrative expenditures include all interest charges, taxes, etc., and because of remission of interest at Delhi do not afford a proper comparison as between the two colonies. Actual administrative expenditures are as follows:

Land Settlement Total	*Durham*	*Delhi*
$381,221 52	$119,302 43	$261,919 09

STATUS OF INVESTMENT OF STATE OF CALIFORNIA

November 30, 1928.

	Expenditures	Not Recoverable	Due from Durham	Due from Delhi
Appropriation Chapter 755, 1917	$ 259,881 05	$9,881 05	$239,728 63	
Appropriation Chapter 450, 1919	1,000,000 00		124,480 52	$875,519 48
Appropriation Chapter 15, 1921	250,000 00			250,000 00
Appropriation Chapter 734, 1921	750,000 00			750,000 00
Appropriation Chapter 205, 1925	250,000 00			230,199 88
*Appropriation Chapter 302, 1925	350,000 00	350,000 00		
†Interest Chapters 450–1919, 15–1921, 734–1921, on $2,000,000, July 1, 1925, to November 30, 1928, 3 5/12 years at $80,000	273,333 33	273,333 33		
Interest, Chapter 205–1925, July 1, 1925, to November 30, 1928	23,298 07			23,298 07
Interest, Chapter 755–1917, to November 30, 1928	43,492 98		43,492 98	
Balance on Land Settlement Fund			10,271 37	19,800 12
	$3,200,005 43	$633,214 38	$417,973 50	$2,148,817 55

*Item of $350,000 is a book appropriation to effect cancellation of interest previously charged against Delhi settlement.

† Item of $273,333.33 represents interest remission under readjustment of 1925, made under authority of Chapter 206, 1925 statutes.

STATEMENT OF ACREAGE—COST AND SELLING PRICE

November 30, 1928.

DELHI

	Number of Acres	Purchase Price	Amount
Alladin Rancho	2607.31	$92 50	$241,176 17
N. E. Orendorff	105.45	130 00	13,708 50
Geo. H. Litteau	198.60	115 00	22,875 00
Mollie E. Wilson	160.00	115 00	18,000 00
Victoria Park Company	40.04	115 00	4,604 60
L. W. Link	9.00	233 33	2,100 00
Edgar M. Wilson	5046.495	92 50	466,800 78
	114.369	130 23	14,794 66
	78.894	100 00	7,989 40
	39.66	134 63	5,339 48
Gross total acreage	8400.818		
Acreage short in survey (deduct)	52.8698		
Title fees			413 57
Improvements sold as land			3,701 92
Additions to cost of land		95 15	794,241 15
Total acquisition	8347.9482	$191 15	$1,595,745 23
Completed sales farm property	75.04	$70 55	$5,293 75
Industrial	6.17	92 27	5,693 00
Townsite	15.3942	269 58	4,150 00
Farm property on contract	4384.10	191 43	839,228 59
Farm property in process of reversion	37.36	276 25	10,320 70
Industrial property on contract	.435	374 74	163 01
Townsite property on contract	3.65	375 75	1,378 80
Unsold land	3825.799	195 96	729,517 38
Total disposition	8347.9482	$191 15	$1,595,745 23

DURHAM

	Number of Acres	Purchase Price	Amount
Stanford University	3882.45	$90 02	$349,499 00
Chas. F. Lott estate	2348.34	65 04	152,735 00
L. M. Compton	8.51	15 00	127 65
Gain in survey	.27		
Additions to cost of land		46 81	292,053 85
Totals	6239.57	$127 32	$794,415 50
Sold for cash	264.74	206 08	54,557 24
Unsold land	865.55	116 67	100,982 85
Reserved lands	30.79	102 23	3,147 72
On sales contract	5078.49	125 18	635,727 69
Totals	6239.57	$127 32	$794,415 50

FINANCIAL STATEMENT

H. W. LEVERS, Chief Accountant; F. A. TAYLOR, Accountant

STATE DEPARTMENT OF AGRICULTURE

Expenditures 78th Fiscal Year, July 1, 1926, to June 30, 1927

Non-self-supporting and partially self-supporting functions		Details	Totals
Administration:			$94,810 22
Director		$9,450 26	
Accounts and disbursements		19,820 53	
General office		31,588 13	
Beesley Building		2,894 07	
Mull Building		19,189 88	
Statistics		10,774 75	
State and county fairs		1,092 60	
Division of chemistry			63,295 91
Chief of division and staff		11,066 50	
Inspections		19,158 62	
Laboratories		33,070 79	
Division of animal industry			228,639 25
Live stock sanitary service		152,629 72	
Chief of division and staff	$21,107 55		
Supervision meat inspection	19,831 41		
Live stock inspections	111,690 76		
Bureau of dairy control		76,009 53	
Chief of bureau and staff	$16,908 33		
Inspections	59,101 20		
Division of plant industry			287,110 83
Bureau of plant quarantine and pest control:			
Chief of bureau		7,229 77	
Plant quarantine service		111,511 38	
Sacramento	$10,808 35		
Border stations	20,985 04		
San Francisco	30,474 42		
San Pedro	21,699 34		
Los Angeles	3,335 86		
San Diego	6,208 37		
Plant pest control		71,494 34	
Entomological work	18,323 67		
Viticulture service	2,268 22		
Plant pathology	7,451 88		
Nursery service	8,613 77		
Rodent control	5,269 78		
Weed control	4,335 96		
Predatory animal control	25 231 06		
Bureau of field crops		73,576 80	
Chief of Bureau and staff	$15,126 90		
Grain inspection service	22,057 81		
Cotton classification service	12,610 00		
Warehouse inspection service	6,653 88		
Seed inspection service	17,128 21		
Bureau of fruit and vegetable standardization		23,298 54	
Fruit and vegetable standardization	$23,298 54		
Division of markets			29,016 05
Advisory service		17,942 87	
Produce news service		6,802 23	
Live stock news service		4,270 95	
Division of weights and measures			10,441 82
Total non-self-supporting and partially self-supporting functions			$713,314 08

Self-supporting functions		Details	Totals
Division of animal industry			$207,897 41
Cattle protection service		$106,026 54	
Brand recording and licensing	$28,492 01		
Hide and brand inspections	77,534 53		
Meat inspection service		101,553 37	
Stallion registration service		317 59	
Division of plant industry			250,386 66
Bureau of fruit and vegetable standardization:			
Apple inspection service		25,017 82	
Shipping point inspection service		225,368 84	
Division of markets			24,240 64
Fish exchange		24,240 64	
Total, self-supporting functions			$482,524 71
Special appropriations			58,565 12
Citrus white fly eradication		49,599 92	
Canned fruit standardization		8,965 20	
Total state department of agriculture (exclusive of foot and mouth disease eradication)			$1,254,403 91
Foot and mouth disease eradication			7,140 51
Total state department of agriculture			$1,261,544 42

NOTE:—During the 78th fiscal year expenditures on account of prior fiscal years (not included in above total) were as follows: 76th fiscal year, $3.20 credit; 77th fiscal year, $54.54; foot and mouth disease eradication $492 45 credit; total expenditures account prior fiscal years, $441.11 credit.

STATE DEPARTMENT OF AGRICULTURE

Recapitulation of Appropriations and Funds, 78th Fiscal Year

Appropriations	Chapter number	Balance as of July 1, 1926	Available by appropriations July 1, 1926	Collections July 1, 1926 to June 30, 1927	Total	Expenditures July 1, 1926 to June 30, 1927	Charges to prior year	Balance as of June 30, 1927
Salaries department of agriculture	30/25	$41,802 09	$469,871 00		$511,673 09	$491,259 55		$20,413 54
Support department of agriculture	30/25	10,636 77	220,844 50		231,185 27	229,195 64	$13 59	2,776 04
Salaries apple inspection	30/25	18,567 26	28,250 00		46,817 26	17,460 90		10,356 36
Support apple inspection	30/25	6,882 27	11,750 00		17,632 27	7,556 92		10,075 35
Salaries cattle protection	30/25	2,415 63	30,900 00		33,315 63	33,315 63		
Support cattle protection	30/25	23 03	51,470 00		51,493 03	51,485 03	8 00	
Salaries fish exchange	30/25		1,320 00		1,320 00	1,320 00		
Support fish exchange	30/25		1,320 00		1,320 00	1,320 00		
Salaries meat inspection	30/25	55,786 36	161,040 00		216,826 36	101,553 37		115,272 99
Salaries stallion registration	30/25	166 00	200 00		400 00	266 00		266 00
Support stallion registration	30/25	94 45	250 00		244 45	117 50		226 95
Salaries shipping point inspection	30/25	2,093 86	134,555 00		136,021 86	129,127 36		7,494 50
Support shipping point inspection	30/25	37 78	90,445 00		90,482 78	90,453 80	7 25	21 64
Cotton white fly eradication	474/25	44,313 92		$20,000 00	64,313 92	49,599 92		14,714 00
Canned fruit standardization	421/25	12,273 58			12,273 58	8,995 20		3,278 38
Support department of agriculture	7/25	1,451 26			1,451 26		*493 35	1,944 61
Emergency resolution No. 19		8,692 69			8,697 69		*2 05	8,694 74
Support department of agriculture	121/23	18 48			18 48		*2 90	21 38
Standard apple preservation fund	680/21	4,039 59		27,714 76	31,754 75	25,017 82		6,736 93
Cattle protection fund	725/21	39,897 46		107,490 31	147,387 77	106,026 54	28 35	41,332 88
Chemistry fund	729/21	5,627 79		45,117 85	50,745 64	43,263 29		7,482 35
Fish exchange fund	803/17	48,912 19		38,562 68	87,474 87	24,240 64		63,234 23
Grain standardization fund	718/21	1,920 27		16,162 83	18,083 10	16,434 26		1,648 84
Meat inspection fund	732/21	85 06		101,941 72	102,027 78	101,553 37		474 41
Stallion registration board contingent fund	782/15	399 12		202 25	602 37	277 50		324 87
Standardization fund	360/25	22,276 09		235,702 26	257,978 35	225,388 84	12 35	32,592 16
Totals		$322,319 40	$1,197,325 50	$592,696 66	$2,112,631 56	$1,755,162 57	*$428 76	$357,897 75
Deduct expenditures charged to both appropriations and funds as provided by Amendment to article IV, Section 34 of Constitution			493,630 50		493,630 50	493,618 15	12 35	
Totals		$322,319 40	$703,695 00	$592,696 66	$1,619,001 06	$1,261,544 42	*$441 11	$357,897 75
Add trust funds		3,290 51		32,494 62	35,785 13	30,802 73		4,982 40
Grand totals		$325,609 91	$703,695 00	$625,481 28	$1,654,786 19	$1,292,347 15	*$441 11	$362,880 15
Add collections credited to general fund				106,160 86				
Add accounts receivable				3,779 55				
Total income				$735,421 69				

*Credit

STATE DEPARTMENT OF AGRICULTURE

Expenditures 79th Fiscal Year, July 1, 1927, to June 30, 1928

Non-self-supporting and partially self-supporting functions		Details	Totals
Administration			$85,898 41
Director		$8,479 53	
Accounts and disbursements		17,566 03	
Beesley Building		2,754 46	
General office		38,497 83	
Mull Building		6,797 10	
Statistics		10,028 27	
State and county fairs		1,775 19	
Division of chemistry			63,858 06
Chief of division and staff		10,153 21	
Inspection service		20,629 71	
General laboratory		16,914 92	
Dairy laboratory		16,160 22	
Division of animal industry			225,644 09
Live stock sanitary service		146,725 97	
Chief of division and staff	$21,659 39		
Supervision meat inspection service	21,270 55		
Live stock inspection service	103,796 03		
Bureau of dairy control		78,918 12	
Chief of bureau and staff	$22,657 12		
Inspection service	56,261 00		
Division of plant industry			293,554 50
Bureau of plant quarantine and pest control:			
Chief of bureau		7,666 24	
Plant quarantine service		119,987 87	
Sacramento	$9,444 35		
Border stations	36,084 60		
San Francisco	41,365 54		
San Pedro	21,835 59		
Los Angeles	3,252 70		
San Diego	8,005 [illegible]		
Plant pest control		64,010 59	
Entomological work	18,232 57		
Plant pathology	8,678 36		
Nursery service	9,270 59		
Rodent control	4,531 62		
Weed control	3,329 98		
Predatory animal control	19,967 47		
Bureau of field crops		70,210 24	
Chief of bureau and staff	$13,799 85		
Grain inspection service	25,829 54		
Cotton classification service	1,071 50		
Warehouse inspection service	11,175 52		
Seed inspection service	18,333 83		
Bureau of fruit and vegetable standardization		31,679 56	
Fruit and vegetable standardization	$22,829 77		
Canned fruit standardization	8,849 79		
Division of markets			35,859 54
Advisory service		23,981 81	
Produce news service		7,424 01	
Live stock news service		4,453 72	
Division of weights and measures			9,791 94
Total non-self-supporting and partially self-supporting functions			$714,606 54

Self-supporting functions		Details	Totals
Division of animal industry			$222,765 01
Cattle protection service		$109,815 34	
Brand recording and licensing	$29,589 77		
Hide and brand inspections	80,225 57		
Meat inspection service		112,640 01	
Stallion registration service		309 66	
Division of plant industry			277,301 87
Bureau of fruit and vegetable standardization:			
Apple inspection service		25,333 87	
Shipping point inspection service		251,968 00	
Division of markets			34,271 67
Fish exchange		25,178 64	
Produce dealers' service		9,093 03	
Division of weights and measures			29,397 98
Upholstered furniture inspection service		14,309 89	
Mattress inspection service		15,088 09	
Total self-supporting functions			$563,736 53
Special appropriations			80,958 46
Terminal weighing service		55 76	
Citrus white fly eradication		43,719 00	
Spray residue inspection service		29,573 01	
Ice cream and containers service		7,610 69	
Total state department of agriculture			$1,359,301 53

NOTE:—During the 79th fiscal year expenditures on account of prior fiscal years (not included in above total) were as follows: 78th fiscal year, $1,895.40; foot and mouth disease eradication, $592.01 credit; total expenditures account prior fiscal years, $1,303.39.

STATE DEPARTMENT OF AGRICULTURE

Recapitulation of Appropriations and Funds, 79th Fiscal Year

Appropriations	Chapter number	Balance as of June 30, 1927	Available by appropriations July 1, 1927	Collections July 1, 1927 to June 30, 1928	Total	Expenditures	Charges to prior year	Balance as of June 30, 1928
Salaries department of agriculture	30/25	$20,413 54			$20,413 54		Cr. $5 66	$20,419 20
Support department of agriculture	30/25	2,276 64			2,276 64		935 40	1,341 24
Salaries apple inspection	30/25	19,356 36			19,356 36			19,356 36
Support apple inspection	30/25	10,075 35			10,075 35		1 25	10,074 10
Salaries meat inspection	30/25	115,272 99			115,272 99			115,272 99
Salaries stallion registration	30/25	200 00			200 00			200 00
Support stallion registration	30/25	226 95			226 95			226 95
Salaries shipping point inspection	30/25	7,494 50			7,494 50			7,494 50
Support shipping point inspection	30/25	21 64			21 64			21 64
Citrus white fly eradication	474/25	14,714 00		$14 000 00	28,714 00	$28,719 00	Cr. 5 00	
Canned fruit standardization	421/25	3,308 38			3,308 38	3,308 38		
Support department of agriculture	7/25	1,944 61			1,944 61		Cr. 592 01	2,536 62
Support apple inspection	142/27		$29,800 00		29,800 00	25,333 87		4,466 13
Support cattle protection	142/27		109,993 25		109,993 25	109,815 34		177 91
Support fish exchange	142/27		30,270 00		30,270 00	25,178 64		5,091 36
Support meat inspection	142/27		126,000 00		126,000 00	112,640 01		13,359 99
Support stallion registration	142/27		435 00		435 00	309 66		125 34
Support shipping point inspection	142/27		250,000 00		250,000 00	249,999 63		37
Leased wire and market news service extension	142/27		20,000 00		20,000 00			20,000 00
Support salary-director	580/27		924 72					
Support department of agriculture	142/27		773,290 50		774,215 22	711,298 16		62,917 06
Shipping point inspection executive order No. 299 (deficiency)			3,000 00		3,000 00	1,968 37		1,031 63
Citrus white fly executive order No. 145			15,000 00		15,000 00	15,000 00		
Spray residue	807/27		70,000 00		70,000 00	29,573 01		40,426 99
Dairy law enforcement	817/27		27,000 00		27,000 00	7,610 69		19,389 31
Deficiency Res. No. 34 cattle protection 78 F. Y.		774 12			774 12		7 20	766 92
Deficiency Res. No. 20 fish exchange 78 F. Y.		4,304 36			4,304 36		515 80	3,788 56
Deficiency Res. No. 39 shipping point inspection		2,212 41			2,212 41		446 41	1,766 00

Funds	Chapter number	Balance as of June 30, 1927	Available by appropriations July 1, 1927	Collections July 1, 1927 to June 30, 1928	Total	Expenditures	Charges to prior year	Balance as of June 30, 1928
Standard apple prosecution fund	660/21	$6,736 93		$26,313 71	$33,050 64	$25,333 87	$1 25	$7,715 52
Cattle protection fund	725/21	41,332 88		100,660 17	141,993 05	109,815 34	7 20 *2,044 10	30,116 41
Fish exchange fund	803/17	63,234 23		21,344 78	84,579 01	25,178 64	515 80	58,884 57
Meat hygiene fund	732/21	474 41		112,512 19	112,986 60	112,640 01		346 59
Stallion registration board contingent fund	752/15	374 87		255 25	630 12	309 66		320 46
Standardization fund	350/25	32,592 16		291,201 81	323,793 97	11,872 08	446 41	
Fruit and vegetable certification fund	542/27					240,095 92		71,379 56
Division of weights and measures fund	399/27			26,065 00	26,065 00	15,088 09		10,976 91
Upholstered furniture inspection fund	405/27			24,530 00	24,530 00	14,309 89		10,220 11
Produce dealers' license fund	860/27			20,475 00	20,475 00	9,093 03		11,381 97
Terminal weighing fund	892/27		$27,500 00		27,500 00	55 76		27,444 24
Totals		$347,341 33	$1,483,213 47	$637,357 91	$2,467,912 71	$1,884,547 05	$4,318 15	$579,047 51
Deduct expenditures charged to both appropriations and funds as provided by amendment to article IV, section 34 of Constitution			528,260 28		528 260 28	525,245 52	3,014 76	
Totals		$347,341 33	$954,953 19	$637,357 91	$1,939,652 43	$1,359,301 53	$1,303 39	$579,047 51
Add trust funds		3,418 85		43,199 64	46,618 49	41,840 88		4,777 61
Grand totals		$350,760 18	$954,953 19	$680,557 55	$1,986,270 92	$1,401,142 41	$1,303 39	$583,825 12
Add collections credited to general fund				178,707 36				
Add accounts receivable				6,708 42				
Total income				$865,973 33				

*Legislative claims:—Chapter 294/27, $1,360.45: chapter 295/27, $683.65.
Cr. Credit.

CALIFORNIA CROP REPORT FOR 1928

E. E. Kaufman, Agricultural Statistician

The total tonnage of crops produced in California in 1928 exceeded that of any previous year. The index of farm prices decreased somewhat as the season advanced and the final estimate of the total returns to the growers of these crops were less than anticipated.

The annual crop survey of California for 1928 shows a total value of all main field, fruit and vegetable crops of $474,269,000. This compares with a like estimate of the 1927 crops of $490,813,000. The hypothetical value of all crops in the various states gives California in 1928 the rank of third place. In 1927 the State also ranked third in the hypothetical value of all crops. Of the main field and fruit crops alone, 12,842,124 tons were harvested in 1928 as compared to 11,782,559 tons in 1927. There was a slight increase in the acreage of all main field crops accompanied by a slight increase in the bearing acreage of fruit crops. While a substantial increase was obtained in the tonnage of all fruit crops in 1928, it was also noted that there was a production of about 225,000 tons which were not harvested and are not included in the estimated tonnage produced and valued the past year. The average value per ton in 1928 of the main field crops was $22.91 compared with $21.32 in 1927 and $23.23, the five-year average (1924-1928). The average value per ton of the fruit crops harvested in 1928 was $45.25 compared with $64.17 in 1927 and the average value for the five-year period (1924-1928) of $57.67. There was in increase of only 550 acres planted to vegetable crops in 1928, but the total valuation of such crops was $75,198,000 as compared with $69,120,000 the previous year.

This report revises the preliminary summary released early in 1929 on the production and value of field, fruit and vegetable crops for 1928 and gives comparative data of California crops for the four previous years. The principal revision of the preliminary summary is in the valuation of all crops. The value of the citrus crop was estimated on the basis of the prices being received at the time the summary was released and when only a small percentage of the 1928-29 crop had been harvested. The prices received by the growers the first six months of the citrus year indicated the value of the crop had been over-estimated; hence, the revision noted. Further revision will more than likely be necessary at the close of the citrus year. The estimates here recorded for 1927 have been revised in accordance with final data now available on acreage and production. The 1928 estimates are subject to a similar revision next year.

The valuation of all crops is based on the average price to the grower prevailing on December 1 or on an average price during the harvest season, delivered at the home-town market, shipping station or packing shed. Prices of the field crops on this basis are quite readily obtained. Quite often fruit prices are given on an f.o.b. basis. Estimates of value herein recorded are on the basis of the naked fruit delivered at the shipping station or packing shed, as f.o.b. prices include the cost of container, cost of packing, and the loading charge. The price of some vegetables to the grower is on an f.o.b. basis in order to maintain a comparative value of the vegetable crops with former years and practices in other states.

In Table 1 are given estimates of the acreage, production in tons and farm value to the grower of the main field crops; the bearing acreage, estimated tonnage and value of the main fruit crops; and the estimated acreage and value only of the vegetable crops produced during the past five years.

Table 1—Acreage, Production and Value of California Crops

Year	Acreage	Production (tons)	Average value per ton	Farm value December 1
FIELD CROPS				
1928	4,706,000	8,147,700	$22 91	$186,654,000
1927	4,669,000	7,804,900	21 32	166,435,000
1926	4,633,400	7,575,600	20 89	158,277,000
1925	4,546,000	8,053,709	23 81	191,785,000
1924	4,049,000	6,725,872	27 79	186,903,000
5-year average (1924-28)	4,520,680	7,661,556	23 23	178,010,800
FRUIT CROPS				
1928	1,690,591	4,694,424	45 25	212,417,000
1927	1,645,249	3,977,659	64 17	255,258,000
1926	1,578,281	4,219,547	56 94	240,244,000
1925	1,474,592	3,735,800	58 83	219,783,000
1924	1,350,875	3,019,658	67 98	205,269,000
5-year average (1924-28)	1,547,918	3,929,418	57 67	226,594,200
VEGETABLE CROPS				
1928	357,240			75,198,000
1927	356,690			69,120,000
1926	327,090			67,332,000
1925	268,150			59,574,000
1924	233,795			48,898,000
5-year average (1924-28)	308,593			64,024,400

SEASONAL CONDITIONS

Weather conditions throughout the year were generally favorable to agriculture. Rainfall was about normal except for some scattered localities in the southern half of the state. Streams supplying gravity irrigation water carried a sufficient flow well into July, and no serious water shortage developed, although many ranchers could have used to good advantage more water than was available late in the season.

There was no injury from late spring frosts in 1928. Temperatures were moderate until June and quite beneficial to wheat, oats and barley, all of which turned out better yields than expected. Throughout July and August temperatures were about normal with a short hot spell the last of July causing some little injury to the grape crop and a limited "heat shed" in a few cotton areas throughout the San Joaquin Valley. The fall months were favorable for maturing rice, cotton and beans and yields generally exceeded expectations.

The character of the recent crop seasons in California is indicated in Table 2 which shows the composite condition of all important crops during months of the growing period, in which 100 represents an average (not normal) condition.

A study of this table indicates that in 1928 the best and most uniform crop conditions prevailed since 1923 and, further, that 1928 was the best all around crop year in the past fourteen years.

Table 2—Monthly Composite Crop Conditions, 1915-1928

	June 1	July 1	August 1	September 1	October 1
1915	112.8	106.7	103.8	101.7	103.5
1916	92.0	95.2	96.4	99.8	101.2
1917	104.5	100.3	97.7	97.6	101.3
1918	98.0	94.2	92.6	89.0	86.5
1919	105.0	101.8	98.0	98.9	100.5
1920	95.8	95.4	96.8	96.5	95.7
1921	96.5	95.0	94.8	95.1	94.7
1922	98.9	100.4	101.7	102.3	101.2
1923	105.9	106.1	106.3	105.7	109.5
1924	87.1	87.2	87.9	85.0	89.4
1925	102.9	103.7	100.5	97.1	107.8
1926	103.1	102.1	102.3	103.7	108.0
1927	96.7	98.4	98.4	103.4	106.7
1928	----------	104.4	106.3	108.7	112.0

WAGES OF FARM LABOR

The wages paid for farm labor have been quite stable for the past four years. Farm labor in California is generally employed on a piece basis or by the day without board; hired farm labor by the month, with or without board, being confined principally to the live stock and dairy industry. In Table 3 is given comparative data on the average wages paid per day for hired farm labor, without board and with board, at times other than harvest, for California; the eleven western states including California; the United States including California; and a percentage comparison of California farm wages and those of the United States.

Table 3—Wages of Farm Labor—Average per Day, Other Than Harvest Time

	Without board				With board			
	California	Eleven western states	United States	California compared with U.S., per cent	California	Eleven western states	United States	California compared with U.S., per cent
1928*	$3 60	$3 28	$2 39	151	$2 60	$2 44	$1 84	141
1927*	3 60	3 29	2 44	148	2 70	2 48	1 89	143
1926*	3 65	3 35	2 46	147	2 65	2 53	1 91	139
1925*	3 60	3 25	2 44	148	2 70	2 49	1 89	143
1924*	3 40	3 16	2 43	140	2 40	2 33	1 87	128
1923*	4 00	3 47	2 45	163	3 12	2 60	1 84	170
1922	3 40	3 00	2 15	158	2 53	2 23	1 65	153
1921	3 35	3 01	2 22	151	2 55	2 26	1 68	152
1920	4 60	4 61	3 59	128	3 60	3 66	2 86	126
1919	3 90	4 02	3 12	125	2 99	3 08	2 45	122
1918	3 25	3 52	2 63	124	2 60	2 76	2 07	126
1917	2 67	2 82	2 02	132	2 04	1 87	1 56	131
1916	2 17	2 24	1 62	134	1 57	1 67	1 26	125
1915	2 10	2 08	1 47	143	1 55	1 54	1 13	137
1914	2 05	2 09	1 45	141	1 44	1 52	1 13	127
1913	2 01	2 07	1 50	134	1 44	1 52	1 16	124
1912	2 03	2 06	1 47	138	1 48	1 54	1 14	130
1911	2 05	2 07	1 42	144	1 48	1 51	1 09	136
1910	2 02	2 06	1 38	146	1 44	1 51	1 06	136

* Data for July 1.

FIELD CROPS

The latest revised estimates of acreage, production and farm value relating to the main field crops of California for the years 1924 to 1928, inclusive, and the 5-year average, are shown in Table 4. In other tables and the discussion that follows are given more details and additional information.

Corn, Indian—The area devoted to the culture of Indian corn in 1928 was about 75,000 acres. Of this total 37,000 acres were for the production of grain, 20,000 acres were grown for silage and 18,000 for forage and hogging-off. By hogging off is understood the harvesting of the crop by the turning of live stock, principally hogs, into the fields of nearly mature corn. Total production data recorded in Table 4 are based on the assumption that the grain yield per acre on acreage grown for silage and forage would be the same as the acreage grown for grain. The estimated yield per acre on the acreage harvested for grain was 33 bushels thus making the total production of corn for grain in 1928 about 1,221,000 bushels compared with 1,287,000 bushels in 1927.

Wheat, Oats and Barley—The wheat acreage decreased in 1928 compared with the previous year while oats and barley both showed substantial increases. Marked increases are shown in the average yield per acre for all three grains with a consequent increase in the total tonnage produced. Total acreages of small grains harvested in California each year are not only dependent on seedings but also on weather conditions that prevail during autumn, winter and spring. In various localities and for the whole state the planted acreage each year is disposed of in three ways, namely: harvested for grain, harvested for hay and abandoned for either grain or hay harvest. With good prospects for a crop of grain at fair prices the tendency is usually toward a smaller acreage of these grains being harvested for hay. The small acreages harvested for grain and the large acreage of grain hay in 1924 were due to the severe drought that prevailed during the winter and spring months. These estimates relate to the entire production of these grains in the state and include all the grain that is consumed as feed or seed in the localities where grown as well as that portion that enters into main trade channels.

Rice—The rice grower was favored with good growing and harvest weather conditions in 1928 and the result was the highest average yield per acre obtained in over ten years. The acreage in the San Joaquin Valley jumped from a few thousand acres to over 19,000. Yields were fair but not so good as in the Sacramento Valley where over 95 per cent of the rice has been grown in previous years. In Table 4 will be found comparative data on acreage, and production for the past five years.

Sugar Beets—Excellent yields with an increased acreage of sugar beets in the Sacramento Valley materially increased the average yield per acre of this crop in California for 1928. Beets grown for the Los Alamitos factory were sliced at Dyer and the Union Sugar Company at Betteravia sent their beets to Oxnard, consequently only four factories were actually operated in 1928. In Table 4 is shown the acreage and production for the past five years. The beet sugar production during recent years in California has been as follows: 1928, 103,000 tons; 1927, 84,000 tons; 1926, 68,000 tons; and in 1925, 88,000 tons.

Table 4—Acreage, Production and Value of Specified Field Crops, 1924-1928

Crop		Acreage	Production			Farm value, Dec. 1	
			Per acre	Total	Unit	Per unit	Total
Corn	1928	75,000	32.00	2,400,000	Bushels	$1.00	$2,400,000
	1927	77,000	32.00	2,464,000	Bushels	1.08	2,661,000
	1926	77,000	31.50	2,426,000	Bushels	1.06	2,572,000
	1925	81,000	35.10	2,843,000	Bushels	1.18	3,355,000
	1924	82,000	33.50	2,747,000	Bushels	1.38	3,791,000
5-year average (1924-28)		78,400	32.86	2,576,000	Bushels	1.15	2,955,800
Wheat	1928	780,000	21.00	16,380,000	Bushels	1.18	19,328,000
	1927	812,000	16.80	13,642,000	Bushels	1.18	16,098,000
	1926	653,000	18.40	12,015,000	Bushels	1.30	15,620,000
	1925	603,000	19.00	11,457,000	Bushels	1.48	16,956,000
	1924	377,000	15.00	5,655,000	Bushels	1.54	8,709,000
5-year average (1924-28)		645,000	18.34	11,829,800	Bushels	1.30	15,342,200
Oats	1928	154,000	34.50	5,313,000	Bushels	.60	3,188,000
	1927	147,000	28.50	4,190,000	Bushels	.63	2,640,000
	1926	156,000	32.50	5,070,000	Bushels	.48	2,434,000
	1925	151,000	34.70	5,240,000	Bushels	.61	3,196,000
	1924	86,000	18.20	1,565,000	Bushels	.87	1,362,000
5-year average (1924-28)		138,800	30.80	4,275,600	Bushels	.60	2,564,000
Barley	1928	1,044,000	30.50	31,842,000	Bushels	.72	22,926,000
	1927	994,000	27.50	27,335,000	Bushels	.93	25,422,000
	1926	1,080,000	30.00	32,400,000	Bushels	.58	18,792,000
	1925	1,050,000	31.00	32,550,000	Bushels	.75	24,412,000
	1924	765,000	21.90	16,754,000	Bushels	1.16	19,435,000
5-year average (1924-28)		986,600	28.56	28,176,200	Bushels	.79	22,197,400
Rice	1928	133,000	60.70	8,073,000	Buhsels	.88	7,104,000
	1927	160,000	56.00	8,960,000	Bushels	1.15	10,304,000
	1926	149,000	53.60	7,986,000	Bushels	1.31	10,462,000
	1925	103,000	46.60	4,800,000	Bushels	1.70	8,160,000
	1924	90,000	48.50	4,365,000	Bushels	1.66	7,246,000
5-year average (1924-28)		127,000	53.83	6,836,800	Bushels	1.27	8,655,200
Grain Sorghum	1928	125,000	33.00	4,125,000	Bushels	.90	3,713,000
	1927	130,000	31.20	4,056,000	Bushels	.97	3,934,000
	1926	96,000	32.00	3,072,000	Bushels	.84	2,580,000
	1925	88,000	34.00	2,992,000	Bushels	1.07	3,201,000
	1924	84,000	30.50	2,562,000	Bushels	1.35	3,459,000
5-year average (1924-28)		104,600	32.14	3,361,400	Bushels	1.00	3,377,400
Beans	1928	250,000	17.70	4,425,000	Bushels	4.40	19,470,000
	1927	296,000	16.30	4,825,000	Bushels	2.70	13,028,000
	1926	305,000	18.80	5,734,000	Bushels	3.00	17,202,000
	1925	240,000	19.00	4,560,000	Bushels	4.10	18,696,000
	1924	206,000	13.10	2,699,000	Bushels	5.20	14,035,000
5-year average (1924-28)		259,400	17.15	4,448,600	Bushels	3.71	16,486,200
Hay (tame)	1928	1,654,000	3.09	5,104,000	Tons	14.50	74,008,000
	1927	1,649,000	3.13	5,156,000	Tons	12.50	64,450,000
	1926	1,699,000	2.93	4,984,000	Tons	12.30	61,303,000
	1925	1,777,000	3.05	5,417,000	Tons	14.00	75,838,000
	1924	1,974,000	2.35	4,642,000	Tons	21.70	100,731,000
5-year average (1924-28)		1,750,600	2.89	5,060,600	Tons	14.87	75,266,000

Table 4—Acreage, Production and Value of Specified Field Crops, 1924-1928—Continued

Crop		Acreage	Production			Farm value, Dec. 1	
			Per acre	Total	Unit	Per unit	Total
Hay (wild)	1928	150,000	1.20	180,000	Tons	$8.50	$1,530,000
	1927	147,000	1.20	176,000	Tons	8.50	1,496,000
	1926	150,000	1.10	165,000	Tons	7.50	1,238,000
	1925	148,000	1.40	207,000	Tons	8.50	1,760,000
	1924	114,000	0.74	84,000	Tons	17.00	1,428,000
5-year average (1924-28)		141,800	1.15	162,400	Tons	9.18	1,490,400
Potatoes	1928	56,000	138.00	7,728,000	Bushels	0.65	5,023,000
	1927	52,000	153.00	7,956,000	Bushels	0.95	7,558,000
	1926	43,000	161.00	6,923,000	Bushels	1.32	9,138,000
	1925	43,000	159.00	6,837,000	Bushels	2.00	13,674,000
	1924	46,000	162.00	7,452,000	Bushels	0.90	6,707,000
5-year average (1924-28)		48,000	153.73	7,379,200	Bushels	1.14	8,420,000
Sweet Potatoes	1928	12,000	96.00	1,152,000	Bushels	1.10	1,267,000
	1927	12,000	90.00	1,080,000	Bushels	1.15	1,242,000
	1926	12,000	97.00	1,164,000	Bushels	1.10	1,280,000
	1925	9,000	112.00	1,008,000	Bushels	1.70	1,714,000
	1924	6,000	94.00	564,000	Bushels	2.18	1,230,000
5-year average (1924-28)		10,200	97.41	993,600	Bushels	1.36	1,346,600
Sugar Beets	1928	49,000	13.00	637,000	Tons	9.00	5,733,000
	1927	59,000	8.10	476,000	Tons	9.28	4,417,000
	1926	46,000	8.00	369,000	Tons	9.25	3,413,000
	1925	76,000	6.45	490,000	Tons	8.21	4,023,000
	1924	84,000	9.35	785,000	Tons	9.14	7,175,000
5-year average (1924-28)		62,800	8.78	551,400	Tons	8.98	4,952,200
Hops	1928	6,000	1580.00	9,480,000	Pounds	0.19	1,801,000
	1927	6,000	1650.00	9,900,000	Pounds	0.20	1,980,000
	1926	5,400	1650.00	8,910,000	Pounds	0.21	1,871,000
	1925	5,000	1600.00	8,000,000	Pounds	0.20	1,600,000
	1924	6,000	1600.00	9,600,000	Pounds	0.11	1,056,000
5-year average (1924-28)		5,680	1615.85	9,178,000	Pounds	0.18	1,661,600
Cotton (lint)[2]	1928	218,000	378.00	82,326,000	Pounds	0.195	16,054,000
	1927	128,000	340.00	43,547,000	Pounds	0.21	9,145,000
	1926	162,000	386.00	62,422,000	Pounds	0.14	8,739,000
	1925	172,000	339.00	58,218,000	Pounds	0.22	12,808,000
	1924	129,000	287.00	37,035,000	Pounds	0.24	8,888,000
5-year average (1924-28)		161,800	350.49	56,709,600	Pounds	0.196	11,126,800
Cotton seed[2]	1928			82,300	Tons	31.50	2,592,000
	1927			43,500	Tons	37.50	1,631,000
	1926			62,400	Tons	19.50	1,217,000
	1925			58,200	Tons	29.50	1,717,000
	1924			37,000	Tons	29.00	1,073,000
5-year average (1924-28)				56,680	Tons	29.04	1,646,000
Alfalfa seed	1928	[3]14,000	3.30	46,200	Bushels	11.20	517,000
	1927	[3]13,300	3.50	46,600	Bushels	9.20	429,000
	1926	[3]14,400	2.75	39,600	Bushels	10.50	416,000
	1925	[3]16,000	3.70	59,200	Bushels	11.40	675,000
	1924	[3]13,500	4.20	56,700	Bushels	10.20	578,000
5-year average (1924-28)		14,240	3.49	49,660	Bushels	10.53	523,000

[1] Subject to revision, as final price to grower not fully determined at this date.
[2] Does not include estimate of 160,000 acres and 80,096 bales grown in Lower California, Mexico.
[3] Included in all tame hay acreage.

Hops—Hop production has not varied much in California the past few years. The area devoted to hop culture in 1928 was about 6000 acres. Some years a few hundred acres will be "laid out" to be brought back into production later on. Oregon and Washington are the principal hop producing states aside from California. Hop statistics for the three states for 1927 and 1928 are recorded in Table 5. In Table 4 is shown the acreage, production and value of the crop in California for the past five years.

Table 5—Hops—Acreage and Production in California, Oregon and Washington

State	Acreage		Yield per acre		Production	
	1927	1928	1927	1928	1927	1928
	Acres	Acres	Pounds	Pounds	Pounds	Pounds
Washington	2,600	3,100	1,867	2,020	4,854,000	6,262,000
Oregon	16,000	17,000	994	1,000	15,904,000	17,000,000
California	6,000	6,000	1,650	1,580	9,900,000	9,480,000
United States	24,600	26,100	1,246	1,254	30,658,000	32,742,000

Other Miscellaneous Crops—In addition to the crops listed in Tables 4, 12, and 16, there are numerous other minor crops that contribute to the agricultural income of the state. Among these may be considered vegetable and flower seeds, mustard seed, sunflower seed, rye, broom corn, peppermint, various small fruits and other miscellaneous crops. Nursery and greenhouse products are important income producers in various districts of the state and gradually increasing in value. In this report no attempt is made to give production or value of miscellaneous crops, nursery and greenhouse products.

Prices of Field Crops—So many questions arise as to the price growers receive for their crops that Table 11 is again inserted showing the average price of the principal field crops received by producers in California for the years 1868 to 1928, inclusive. Source of data is the United States Department of Agriculture Statistical Bulletin No. 17. Price data by months for recent years are to be found in the same bulletin. The farm value of all crops is based on the average price to the grower prevailing on December 1, or on an average price received during the harvest season delivered at the home-town market, shipping station or packing shed. F.o.b. prices so often quoted include the cost of container, cost of packing, and the loading charge, which for fruits and vegetables is sometimes greater than the farm value.

Beans—The bean crop of 1927 moved to market slowly with a consequent heavy holdover when the time came for planting the 1928 crop. As a result there was a decrease in the acreage planted to both limas and "beans other than limas." A larger percentage of acreage planted to limas was irrigated than heretofore, which resulted in an increased yield per acre compared with the previous year. The yield per acre for "beans other than limas" was about the same for both years.

Table 6 shows the estimated acreage of all beans and the production in 100-pound bags segregated by varieties of California beans from 1923 to 1928, inclusive.

Table 6—Estimated Bean Production by Varieties, in 100-pound Bags, 1923-1928

	1923	1924	1925	1926	1927	1928
Limas	830,000	480,000	800,000	1,250,000	1,010,000	890,000
Baby limas	220,000	225,000	300,000	580,000	310,000	348,000
Small whites	360,000	77,000	200,000	180,000	280,000	342,000
Large whites	100,000	40,000	25,000	15,000	15,000	18,000
Pinks	650,000	260,000	625,000	580,000	520,000	450,000
Blackeyes	275,000	277,000	450,000	450,000	300,000	282,000
Red kidneys	40,000	20,000	30,000	45,000	60,000	30,000
Cranberries	143,000	70,000	60,000	73,000	110,000	60,000
Mexican reds	60,000	60,000	132,000	80,000	125,000	66,000
Bayos	30,000	20,000	15,000	21,000	25,000	9,000
Miscellaneous	33,000	40,000	30,000	40,000	50,000	72,000
Total production	2,741,000	1,569,000	2,667,000	3,314,000	2,805,000	2,567,000
Harvested acreage	299,000	206,000	240,000	305,000	296,000	250,000

Hay—Statistical information relative to the California hay crops shown by types for the past three years is recorded in Table 7. Nearly all the alfalfa in California is grown by irrigation and with the exception of a few areas there was an ample supply of water in 1928 until late in the season. Under normal conditions the acreage and production of hay crops shows little change from year to year, as indicated by the table. In the drought year (1924) there was a large increase in the acreage of grains cut for hay with almost a corresponding decrease in the acreage harvested for grain. At the present writing it appears that somewhat similar conditions will prevail this year (1929). The estimates in this report relative to grain hay are separate and exclusive of all acreage and production data relating to wheat, barley and oats for grain.

Table 7—California Hay by Types: Estimated Acreage and Production. (000 omitted)

Type	Acreage (thousands of acres)			Yield per acre (in tons)			Production (thousands of tons)		
	1926	1927	1928	1926	1927	1928	1926	1927	1928
Alfalfa	981	1,001	1,011	4.00	4.20	4.20	3,924	4,204	4,246
Grain hay	616	546	546	1.40	1.40	1.30	862	764	710
Clover	8	8	8	1.60	1.50	1.50	13	12	12
Timothy	4	4	4	1.60	1.50	1.50	6	6	6
Mixed—clover and timothy	20	20	19	1.60	1.50	1.80	32	30	34
Millet, Sudan grass, etc.	70	70	66	2.10	2.00	1.45	147	140	96
Total—all tame hay	1,699	1,649	1,654	2.93	3.13	3.09	4,984	5,156	5,104
Wild hay	150	147	150	1.10	1.20	1.20	165	176	180
Total—all hay	1,849	1,796	1,804	2.78	2.97	2.93	5,149	5,332	5,284

Cotton—Cotton production in 1928 in California was again quite satisfactory. A greater acreage was devoted to this crop than in any previous year. From 218,000 acres 172,230 bales were harvested. This is the first time that California has produced as much as 1 per cent of the nation's total cotton crop. The average state yield of 378 pounds per acre was almost two and one-half times as great as the average for the entire cotton acreage of the United States.

Profits made by cotton farmers were, however, due to good yields rather than good price. The prices received were only partially satisfactory as the 1928 crop was generally sold without the customary premium over basis price for the better grades and staples, as had prevailed during other recent years.

The large acreage increase in 1928 seemed to reflect the results from the quite satisfactory returns from the 1927 crop. The greatest amount of new acreage for cotton was in the San Joaquin Valley. Plantings were normally early with only an average amount of replanting found necessary. The spring and early summer months were relatively cool with the exception of a few days in early June. During midsummer most of the cotton valleys experienced hot weather, but no serious heat sheds occurred except where water supplies were inadequate. The Palo Verde Valley was the only area where irrigation water supplies were decidedly below normal supplies and actual demands. The crop in that valley was seriously reduced by the lack of irrigation at critical periods. Killing frosts occurred in most areas during mid-November. In the San Joaquin and Sacramento Valleys, where early fall rains and foggy weather are the dread of the cotton farmer, the first general rain occurred on November 14 and 15. However, there was little damage to the unharvested cotton until late November when a short fog period occurred. In late December and early January there was much cold, wet weather that made late harvesting decidedly difficult.

There were local infestations of aphis and leaf eating insects in some counties, although no widespread damage resulted from insect pests except in Lower California, Mexico where leaf worm ravages during August seriously reduced the total production.

Despite all the local injuries of all kinds, the net result for the state was satisfactory, as an average yield of 378 pounds per acre can not often be expected from as large an acreage.

In Tables 8 and 9 are recorded acreage and production data for counties and valleys in California during recent years. Table 10 shows the production in California, the United States and the World from 1910 to 1928.

Table 8—Cotton Acreage and Production in California by Counties, 1926-1928

County or valley	Acreage picked			Yield per acre pounds fiber			Production—bales (500 lbs. gross)		
	1926	1927	1928	1926	1927	1928	1926	1927	1928
Sacramento Valley	3,300	2,000	9,500	110	134	157	762	560	3,122
Stanislaus and San Joaquin Counties	3,000	1,000	1,600	149	174	280	934	363	937
Merced County	9,300	5,000	17,200	278	236	248	5,405	2,464	8,916
Madera County	9,800	7,600	15,300	309	321	324	6,333	5,108	10,357
Fresno County	20,700	9,500	27,100	346	437	441	14,986	8,681	25,002
Kings County	11,200	9,000	15,100	509	382	507	11,933	7,193	16,006
Tulare County	22,300	18,900	34,600	510	437	496	23,803	17,284	35,903
Kern County	33,000	28,800	41,000	510	465	501	35,237	28,013	42,973
All San Joaquin Valley	109,300	79,800	151,900	431	414	441	98,631	69,106	140,094
Coachella Valley	3,100	1,350	1,800	364	322	338	2,358	910	1,274
Palo Verde Valley	20,000	21,250	22,600	361	275	258	15,083	12,210	12,198
All Riverside County	23,100	22,600	24,400	361	278	264	17,441	13,120	13,472
Imperial Valley, California	20,400	18,800	25,000	204	130	203	8,704	5,099	10,617
Bard Valley	5,900	4,800	7,200	409	321	327	5,052	3,218	4,925
All Imperial County	26,300	23,600	32,200	250	169	231	13,756	8,317	15,542
California total	162,000	128,000	218,000	386	340	378	130,590	91,103	172,230
Imperial Valley (that part in Mexico)	130,000	110,000	160,000	317	194	239	86,285	44,611	80,096

Table 9—Acreage and Production of Cotton in California, 1919-1928

Item and year	San Joaquin Valley	Riverside County	Imperial County	Total California	Imperial Valley (that part in Mexico)	Combined total
Acres picked:						
1919	5,500	19,500	60,000	85,000	100,000	185,000
1920	21,000	25,000	104,000	150,000	125,000	275,000
1921	3,500	14,000	37,500	55,000	85,000	140,000
1922	2,500	16,000	48,500	67,000	135,000	202,000
1923	9,000	21,200	52,800	83,000	150,000	233,000
1924	37,800	25,000	66,200	129,000	137,000	266,000
1925	96,600	23,340	48,600	[1]172,000	150,000	[1]322,000
1926	109,300	23,100	26,300	[2]162,000	130,000	[2]292,000
1927	79,800	22,600	23,600	[3]128,000	110,000	[3]238,000
1928	151,900	24,400	32,200	[4]218,000	160,000	[4]378,000
Average yield per acres, pounds fiber:						
1919	242	389	222	262	258	260
1920	212	349	180	212	303	254
1921	245	357	175	226	280	259
1922	301	239	113	150	205	187
1923	488	388	253	313	276	289
1924	450	296	191	287	247	266
1925	393	384	222	[1]339	255	[1]300
1926	431	361	250	[2]386	317	[2]355
1927	414	278	169	[3]340	194	[3]273
1928	441	264	231	[4]378	239	[4]319
Production, pounds fiber:						
1919	1,332,664	7,593,030	13,348,628	22,274,322	25,812,000	48,086,322
1920	4,446,356	8,726,846	18,701,272	31,874,474	37,857,600	69,732,074
1921	856,098	4,999,880	6,570,036	12,426,014	23,810,614	36,236,628
1922	752,836	3,826,390	5,503,387	10,082,613	27,724,000	37,806,613
1923	4,392,342	8,219,688	13,378,122	25,990,152	41,336,500	67,326,652
1924	17,026,838	7,394,182	12,613,942	37,034,962	33,778,826	70,813,788
1925	37,972,320	8,954,374	10,809,492	[1]58,218,010	38,273,938	[1]96,491,948
1926	47,145,621	8,336,519	6,575,278	[2]62,421,711	41,244,336	[2]103,666,047
1927	33,032,702	6,271,436	3,975,582	[3]43,547,441	21,324,024	[3]64,871,465
1928	66,964,932	6,439,616	7,429,076	[4]82,325,940	38,285,888	[4]120,611,828
Production, 500-pound gross bales:						
1919	2,788	15,885	27,926	46,599	54,000	100,599
1920	9,302	18,257	39,124	66,683	79,200	145,883
1921	1,791	10,460	13,745	25,996	49,813	75,809
1922	1,575	8,005	11,513	21,093	58,000	79,093
1923	9,189	17,196	27,988	54,373	86,478	140,851
1924	35,621	15,469	26,389	77,479	70,667	148,146
1925	79,440	18,733	22,614	[1]121,795	80,071	[1]201,866
1926	98,631	17,441	13,756	[2]130,590	86,285	[2]216,875
1927	69,106	13,120	8,317	[3]91,103	44,611	[3]135,714
1928	140,094	13,472	15,542	[4]172,230	80,096	[4]252,326

[1] 1925—3,500 acres of cotton were harvested in the Sacramento Valley, with a production of 1,000 bales (500-lb. gross), which are included in the totals of the above table.

[2] 1926—3,300 acres of cotton were harvested in the Sacramento Valley, with a production of 762 bales (500-lb. gross), which are included in the totals in the above table.

[3] 1927—2,000 acres of cotton were harvested in the Sacramento Valley with a production of 560 bales (500-lb. gross), which are included in the totals in the above table.

[4] 1928—9,500 acres of cotton were harvested in the Sacramento Valley with a production of 3,122 bales (500-lb. gross), which are included in the totals in the above table.

Table 10—Cotton Acreage and Production—California, United States and World, 1910-1928

Year	California		United States			Estimated world production in thousands of bales	Average farm price Dec. 1 (cents per lb.)	
	Acreage harvested	Production bales	Acreage planted	Acreage harvested	Production bales		California	United States
			(000 omitted)					
1910	9,000	6,300	33,418	32,403	11,609	21,915	13.3	14.1
1911	12,000	9,800	36,681	36,045	15,693	25,356	7.5	8.8
1912	9,000	8,500	34,766	34,283	13,703	25,043	12.5	11.9
1913	14,000	14,600	37,458	37,089	14,156	26,259	13.0	12.2
1914	38,000	27,126	37,406	36,832	16,135	28,687	7.0	6.8
1915	12,000	8,741	32,107	31,412	11,192	20,689	11.2	11.3
1916	60,000	41,235	36,052	34,985	11,450	19,845	20.0	19.6
1917	78,000	37,193	34,925	33,841	11,302	19,675	28.0	27.7
1918	78,000	46,908	37,207	36,008	12,041	20,613	30.0	27.6
1919	85,000	46,599	35,133	33,566	11,421	21,384	43.0	35.6
1920	150,000	66,683	37,043	35,878	13,440	20,875	30.0	13.9
1921	55,000	25,996	31,678	30,509	7,954	15,330	17.0	16.2
1922	67,000	21,093	34,016	33,036	9,762	18,900	26.0	23.8
1923	83,000	54,373	38,701	37,123	10,140	19,300	32.0	31.0
1924	129,000	77,479	42,641	41,360	13,628	24,800	24.0	22.6
1925	172,000	121,795	48,090	46,053	16,104	27,900	22.0	18.2
1926	162,000	130,590	48,730	47,087	17,911	28,000	14.0	10.9
1927	128,000	91,103	41,905	40,138	12,955	23,800	21.0	19.6
1928	218,000	172,230	46,946	45,341	14,478	25,000	19.5	18.0

Table 11—December 1 Farm Price of California Crops, 1868-1928

Year	Wheat, cents per bushel	Corn, cents per bushel	Oats, cents per bushel	Barley, cents per bushel	Rice, cents per bushel	Potatoes, cents per bushel	Sweet potatoes, cents per bushel	*Tame hay, dollars per ton	Wild hay, dollars per ton	Cotton cents per pound
1868	103	100	70	103	-------	56	-------	15.00	-------	-------
1869	93	90	62	65	-------	79	132	12.70	-------	-------
1870	110	120	59	98	-------	135	145	16.70	-------	-------
1871	141	116	70	108	-------	91	110	21.85	-------	-------
1872	111	100	74	85	-------	113	94	15.60	-------	-------
1873	132	73	84	85	-------	85	113	16.50	-------	-------
1874	99	98	69	78	-------	111	112	15.09	-------	-------
1875	118	107	72	91	-------	94	116	16.59	-------	-------
1876	114	107	74	69	-------	83	-------	11.61	-------	-------
1877	130	95	73	90	-------	75	-------	15.00	-------	-------
1878	103	60	69	65	-------	98	-------	12.61	-------	-------
1879	123	79	67	56	-------	65	78	9.93	-------	-------
1880	96	76	65	61	-------	79	92	12.72	-------	-------
1881	103	78	60	70	-------	80	-------	12.20	-------	-------
1882	90	85	58	67	-------	60	87	13.00	-------	-------
1883	100	85	58	63	-------	60	83	12.50	-------	-------
1884	72	60	38	52	-------	60	83	10.31	-------	-------
1885	67	68	48	79	-------	63	-------	11.50	-------	-------
1886	73	62	44	65	-------	66	64	8.15	-------	-------
1887	74	61	58	52	-------	57	81	11.50	-------	-------
1888	85	70	60	58	-------	61	85	12.03	-------	-------
1889	70	57	45	45	-------	45	63	9.25	-------	-------
1890	76	65	56	75	-------	68	70	10.50	-------	-------
1891	95	71	60	61	-------	54	76	11.00	-------	-------
1892	68	55	40	47	-------	59	-------	8.76	-------	-------
1893	53	50	38	42	-------	50	-------	7.87	-------	-------
1894	57	57	44	45	-------	49	61	9.50	-------	-------
1895	60	53	39	40	-------	48	73	7.06	-------	-------
1896	83	53	44	48	-------	53	56	6.35	-------	-------
1897	83	56	49	54	-------	49	60	9.00	-------	-------
1898	72	62	50	65	-------	55	-------	14.25	-------	-------
1899	62	60	47	50	-------	63	67	8.00	-------	-------
1900	58	61	46	43	-------	53	63	8.15	-------	-------
1901	60	68	44	41	-------	77	65	7.92	-------	-------
1902	80	77	51	63	-------	58	76	9.41	-------	-------
1903	87	74	54	61	-------	66	84	11.66	-------	-------
1904	88	78	57	60	-------	67	77	10.41	-------	-------
1905	82	76	51	59	-------	67	75	10.05	-------	-------
1906	75	67	52	54	-------	74	90	11.25	-------	-------
1907	98	85	71	78	-------	90	97	12.50	-------	-------
1908	102	88	67	74	-------	77	80	13.25	-------	-------
1909	111	91	66	74	-------	77	90	11.50	-------	-------
1910	94	80	50	55	65	85	95	9.60	-------	13.3
1911	88	90	59	85	75	90	110	10.90	-------	7.5
1912	93	85	55	70	91	65	94	13.70	-------	12.5
1913	95	88	60	68	100	70	100	13.50	-------	13.0
1914	104	87	53	59	100	70	87	8.20	6.00	7.0
1915	95	88	50	62	90	75	80	11.20	9.00	11.2
1916	152	124	72	95	78	140	100	12.60	11.00	20.0
1917	200	185	85	120	175	150	150	19.20	13.50	28.0
1918	216	193	94	115	190	120	150	20.00	19.00	30.0
1919	204	179	96	141	267	171	179	17.20	12.00	43.0
1920	180	120	80	100	121	150	160	20.00	12.00	30.0
1921	107	77	51	56	115	130	125	11.00	7.00	17.0
1922	115	100	64	63	110	72	67	15.00	9.00	26.0
1923	108	108	60	70	112	112	165	14.00	10.00	32.0
1924	154	138	87	116	166	90	218	21.70	17.00	24.0
1925	148	118	61	75	170	200	170	14.00	8.50	22.0
1926	130	106	48	58	131	132	110	12.30	7.50	14.0
1927	118	108	63	93	115	95	115	12.50	8.50	21.0
1928	118	100	60	72	88	65	110	14.50	8.50	19.5

* Includes alfalfa, grain hay and miscellaneous tame hay.

TRUCK CROPS IN 1928

Truck crops in California for 1928 were favored with conditions somewhat above the average, taking all crops into consideration. During the spring, rains came at such a time as to insure the successful growing of the crops. Summer temperatures were favorable and crops grew to produce excellent quality and average yields. The fall crops while making fair quality were for the most part under the average in yields per acre. This was more than made up by the realization of good prices on practically all commodities as the year drew to a close.

The total acreage devoted to vegetable crops was approximately the same for the years 1927 and 1928. Although a decrease of approximately 17,000 acres occurred in the Imperial Valley lettuce and cantaloupe acreage, lettuce in "other than the Imperial Valley" increased over 8000 acres. Small increases in practically all other vegetables brought the total up to 357,240 acres for 1928 against 356,690 in 1927. An increase of $6,078,000 in the total value indicates greater returns per acre as the yields per acre averaged about the same as in 1927.

California's outstanding vegetable crops which returned satisfactory profits to the grower were: Imperial Valley lettuce, summer and fall lettuce, tomatoes, late onions, carrots, canning asparagus, cantaloupes, and watermelons. The important crops to bring unsatisfactory returns to the grower were: Bermuda onions, early potatoes, spring lettuce, and cauliflower. Other vegetable crops returned some profit which on the average could only be classed as fair. Again over-production was the key note of those crops which were grown without profit. With the exception of Bermuda onions, the crops which showed a loss in 1928 were those which were spectacular during 1927 for their returns to the grower and were crops in which acreages had been greatly increased. The profitable crops of the 1928 season were for the most part those which had been unsatisfactory the preceding year; crops which showed reductions in acreage or very conservative increases.

Factors such as weather, insect pests and plant diseases, which tend to increase or decrease yields, are those over which there is but very little control. Acreages can be controlled and the conservative planting of vegetable crops is the surest solution of the over-production problem.

Winter Vegetables—Weather conditions were for the most part satisfactory to the vegetable grower and good yields and quality were obtained on practically all of the winter crops. A reduction of 12,400 acres in the area planted to lettuce in the Imperial Valley lead to a season which, while not spectacular, was generally satisfactory to the grower. Good quality was maintained throughout the season and the yields were generally good. Cauliflower with a greatly increased acreage brought poor returns to the grower. The quality was good and yields were higher than in 1927. Celery was more or less of a disappointment. The yields were low and the average returns to growers were below those of 1927 which was not considered a good year from the standpoint of returns to the grower.

Spring Vegetables—Sufficient rains which came at such times as to insure satisfactory yields on most spring crops were of material benefit. Spring lettuce came in with exceptional quality and high yields which, coupled with an increase in acreage, so greatly increased the production

that the deal was, as a whole, unprofitable. Spring cauliflower continued along the path of the winter crop and was generally unsatisfactory. Spring carrots came in with high yields and good quality and made fair returns to the growers. Carrots were grown in practically all vegetable growing sections but the main center is the Santa Maria Valley in Santa Barbara County. Carlot shipments of California carrots for the year 1928 were 3632 cars, an increase of 3300 cars over 1925. Carrots were shipped each month of the year during 1927 and 1928. It would seem that with Texas adopting the California methods of packing and style of package, the top limit of profitable shipments from this state had been reached, and conservative plantings will be necessary in the future.

Coachella Valley Bermuda onions met with a disastrous season. Ideal growing weather brought on good yields. Texas, the main producing center of Bermuda onions in the United States, was late with the harvest due to weather conditions, and the two sections were forced to harvest simultaneously. Because of the poor keeping qualities of the Bermuda onion, storage is not an economic procedure and approximately 175,000 bushel crates were abandoned. The acreage planted to Bermudas in Kern and Tulare Counties was all harvested but the returns were very unsatisfactory.

Imperial Valley Cantaloupes—Growing conditions were ideal for melons in the valley and good yields of good quality fruit were generally secured. While this commodity has several factors which influence marketing, cantaloupes went through a season which competed with other fruits to good advantage. Shipments were fairly steady throughout the season and the disastrous peak shipments of former years were moderated. While the area planted was some 4500 acres less than that of 1927 total carlot shipments were greater by some 650 cars, and prices were generally satisfactory.

Early potatoes came in with high yields and due to a large increase in acreage, the greatly increased production caused a disastrous season for the growers. A reduction in the acreage devoted to spring peas as against 1927 brought about fairly satisfactory returns to the growers.

Summer Vegetables—Good prices prevailed for summer crops. Watermelons, lettuce, and cantaloupes were favored with ideal weather conditions and high yields were realized. The production of late onions fell short of the 1927 figure, but the returns to the grower more than made up the difference and the deal was generally satisfactory from the grower's standpoint.

Fall Vegetables—Lettuce and tomatoes comprised the principal fall crops shipped from the state. There were 19,120 acres devoted to the fall planting of lettuce and yields above the average were obtained. Good marketing conditions prevailed throughout the season which caused lettuce to be one of the outstanding crops of the year. Tomatoes also were harvested under favorable market conditions and the average yield per acre for the State was higher than in 1927. The southern districts suffered from late blight, although perhaps not as severely as the year before. In some of the northern districts yields were influenced by dry conditions, but the deal as a whole was satisfactory to the grower.

VEGETABLE CROPS

California continues to be the leading state in the production of vegetables. While practically no change was recorded in the acreage of vegetable crops the past year, better yields and better prices generally brought returns to the growers of six million dollars greater than in 1927. In Table 1 are included estimates of total acreage and value of all commercial vegetable crops in California from 1924 to 1928 inclusive. Data for 1928 is subject to revision.

Table 12 shows the acreage, production, and value of specified commercial vegetable crops. Potatoes and sweet potatoes are classed as field crops in this report. Other vegetables of lesser importance have been grouped under the heading "All Other Vegetables." The value of vegetable crops in this table is calculated both on the cash to grower and f.o.b. basis in order to maintain comparative values with other states.

Table 12—Acreage, Production and Value of Specified Truck Crops, 1925-1928

Crop		Acreage	Production	Unit	Value
Artichokes	1928	8,550	1,039,000	40 lb. boxes	$2,042,000
	1927	9,940	1,272,000	40 lb. boxes	2,569,000
	1926	11,760	1,470,000	40 lb. boxes	2,602,000
	1925	10,550	1,266,000	40 lb. boxes	2,279,000
Asparagus (canning)	1928	49,300	64,100	Tons	5,087,000
	1927	48,300	53,100	Tons	3,717,000
	1926	46,300	50,900	Tons	3,374,000
	1925	34,800	45,200	Tons	3,542,000
Asparagus (table)	1928	10,400	1,633,000	28 lb. crates	3,707,000
	1927	10,080	1,341,000	28 lb. crates	4,010,000
	1926	9,980	1,856,000	28 lb. crates	6,051,000
	1925	6,600	1,115,000	28 lb. crates	2,286,000
Beans, green (canning)	1928	480	2,200	Tons	176,000
	1927	450	2,000	Tons	170,000
	1926	700	3,200	Tons	259,000
	1925	700	1,400	Tons	112,000
Beans, green (table)	1928	3,250	429,000	32 qt. hampers	686,000
	1927	3,120	484,000	32 qt. hampers	852,000
	1926	3,000	645,000	32 qt. hampers	940,000
	1925	2,000	430,000	32 qt. hampers	752,000
Cabbage	1928	6,400	38,400	Tons	1,190,000
	1927	6,350	40,000	Tons	720,000
	1926	6,480	42,100	Tons	1,201,000
	1925	6,080	42,600	Tons	781,000
Cantaloupes (Imperial)[1]	1928	33,460	6,224,000	Standard crates	9,958,000
	1927	37,920	6,029,000	Standard crates	8,983,000
	1926	35,300	5,048,000	Standard crates	6,512,000
	1925	27,560	4,961,000	Standard crates	10,269,000
Cantaloupes (other districts)[1]	1928	10,250	2,112,000	Standard crates	2,260,000
	1927	7,800	1,513,000	Standard crates	2,723,000
	1926	8,380	1,575,000	Standard crates	2,520,000
	1925	10,620	1,699,000	Standard crates	1,971,000
Carrots	1928	4,860	1,200,000	Lettuce crates	1,932,000
	1927	3,050	763,000	Lettuce crates	1,091,000
	1926	1,800	482,000	Lettuce crates	694,000
	1925	1,000	285,000	Lettuce crates	527,000

Table 12—Acreage, Production and Value of Specified Truck Crops, 1925-1928—Continued

Crop		Acreage	Production	Unit	Value
Cauliflower	1928	12,800	3,558,000	Pony crates	$2,989,000
	1927	8,950	2,452,000	Pony crates	2,452,000
	1926	10,500	3,224,000	Pony crates	2,837,000
	1925	6,610	2,148,000	Pony crates	2,384,000
Celery	1928	9,050	1,201,000	California crates	2,697,000
	1927	8,550	1,385,000	California crates	3,782,000
	1926	8,550	1,385,000	California crates	3,782,000
	1925	6,250	913,000	California crates	2,040,000
Cucumbers (pickle)	1928	2,760	11,149	Tons	301,000
	1927	2,120	8,087	Tons	327,000
	1926	2,560	8,855	Tons	343,000
	1925	3,210	11,784	Tons	535,000
Cucumbers (table)	1928	1,050	181,000	32 qt. hampers	192,000
	1927	1,000	163,000	32 qt. hampers	158,000
	1926				
	1925				
Lettuce (Imperial)	1928	22,000	3,740,000	4 doz. crates	6,059,000
	1927	34,400	[3]3,579,000	4 doz. crates	4,796,000
	1926	28,000	4,900,000	4 doz. crates	9,555,000
	1925	23,000	4,600,000	4 doz. crates	7,866,000
Lettuce (other districts)	1928	50,570	7,636,000	4 doz. crates	14,050,000
	1927	42,010	6,049,000	4 doz. crates	10,586,000
	1926	37,100	5,565,000	4 doz. crates	7,624,000
	1925	24,680	4,368,000	4 doz. crates	5,067,000
Onions (Bermuda)	1928	3,950	[3]805,000	Bushels	620,000
	1927	3,950	1,118,000	Bushels	2,012,000
	1926	2,850	926,000	Bushels	1,287,000
	1925	1,550	488,000	Bushels	849,000
Onions (late)	1928	5,940	1,760,000	Bushels	2,137,000
	1927	5,800	2,053,000	Bushels	1,560,000
	1926	6,250	1,781,000	Bushels	1,140,000
	1925	5,850	1,755,000	Bushels	2,036,000
Peas (canning)	1928	1,230	1,230	Tons	69,000
	1927	750	1,050	Tons	63,000
	1926	2,680	3,200	Tons	208,000
	1925	4,890	3,400	Tons	217,000
Peas (table, Imperial)	1928	9,000	540,000	32 qt. hampers	1,247,000
	1927	5,700	365,000	32 qt. hampers	774,000
	1926	4,000	400,000	32 qt. hampers	944,000
	1925	1,400	66,000	32 qt. hampers	169,000
Peas (table, other districts)	1928	16,810	1,967,000	32 qt. hampers	4,013,000
	1927	21,110	2,132,000	32 qt. hampers	4,221,000
	1926	11,950	598,000	32 qt. hampers	2,727,000
	1925	5,100	224,000	32 qt. hampers	618,000
Spinach (canning)	1928	12,340	65,400	Tons	1,014,000
	1927	10,300	51,500	Tons	747,000
	1926	9,590	46,000	Tons	743,000
	1925	9,690	29,100	Tons	513,000
Spinach (table)	1928	1,000	377,000	24 lb. crates	392,000
	1927	1,900	760,000	24 lb. crates	456,000
	1926	2,290	916,000	24 lb. crates	495,000
	1925	1,810	452,500	24 lb. crates	262,000
Strawberries (southern)	1928	1,600	8,320,000	Quarts	1,414,000
	1927	1,620	8,664,000	Quarts	2,079,000
	1926	820	3,317,000	Quarts	597,000
	1925	1,150	5,060,000	Quarts	961,000

Table 12—Acreage, Production and Value of Specified Truck Crops, 1925-1928—Continued

Crop		Acreage	Production	Unit	Value
Strawberries (other districts)	1928	2,150	8,925,000	Quarts	$1,339,000
	1927	2,130	9,419,000	Quarts	2,072,000
	1926	2,090	8,747,000	Quarts	1,749,000
	1925	2,020	10,100,000	Quarts	2,323,000
Tomatoes (canning)	1928	25,790	201,200	Tons	2,929,000
	1927	28,760	178,300	Tons	2,674,000
	1926	32,250	206,400	Tons	3,222,000
	1925	30,000	180,000	Tons	2,932,000
Tomatoes (table)	1928	21,850	2,920,000	36 lb. lugs	2,568,000
	1927	22,850	2,931,000	36 lb. lugs	2,265,000
	1926	13,090	3,297,000	36 lb. lugs	2,733,000
	1925	12,160	3,860,000	36 lb. lugs	4,281,000
Watermelons (Imperial)	1928	8,000	3,776	Cars	680,000
	1927	5,500	3,597	Cars	432,000
	1926	6,000	4,560	Cars	456,000
	1925	4,000	3,000	Cars	750,000
Watermelons (other districts)	1928	4,400	2,600	Cars	450,000
	1927	4,280	1,644	Cars	229,000
	1926	6,820	3,008	Cars	337,000
	1925	6,370	2,548	Cars	502,000
All other vegetables[4]	1928	18,000	73,000	Tons	3,000,000
	1927	18,000	73,000	Tons	2,600,000
	1926	16,000	64,000	Tons	2,400,000
	1925	18,500	74,000	Tons	2,750,000
Totals	1928	357,240			$75,198,000
	1927	356,690			69,120,000
	1926	327,090			67,332,000
	1925	268,150			59,574,000

[1] Includes cantaloupes, noneydews, honeyballs, casabas and Persians.
[2] In addition 1,650,000 crates of lettuce were not harvested.
[3] In addition, 175,000 bushel crates of Bermuda onions were not harvested in the Coachella Valley.
[4] Includes endive, peppers, beets, radishes, rhubarb, pumpkins, squash, sweet corn and turnips.

SHIPMENTS OF CALIFORNIA VEGETABLES

In Table 13 are given the carlot shipments of specified California vegetables by months for the calendar years 1923 to 1928, inclusive. The different crop seasons as well as the volume of shipments and the increase or decrease in shipments from year to year, can readily be determined by a study of this table. From a movement of 64,789 cars in 1923, the number has increased year by year to reach the grand total of 112,672 cars in 1928. Carrots have held first place in the increased movement of vegetables, 27 cars having been shipped in 1923 and 3632 cars in 1928. Lettuce shipments jumped from 15,113 to 33,446 cars during the six-year period. During February, 1928, lettuce shipments amounted to 4817 cars, or an average of 166 cars daily; while in May, 160 cars moved daily and 4949 during the month. The least number of cars to move during any month was in December when 1205 cars were shipped. During the six-year period shipments of lettuce, cauliflower, and celery have more than doubled; the melon movement has increased about 50 per cent and quite an important increase is noted in the shipment of asparagus and tomatoes.

Total shipments for 1928 show lettuce leading with 33,446 cars; cantaloupes second with 25,271; and celery third with 9434 cars.

Table 13—Carlot Shipments of California Vegetables by Months—1923-1928

Crop		1923	1924	1925	1926	1927	1928
Artichokes	Jan.	34	42	77	102	157	117
	Feb.	53	102	200	257	168	158
	Mar.	261	237	428	442	154	258
	April	207	360	198	130	145	97
	May	22	44	30	19	62	25
	June		2	4			2
	July			2			7
	Aug.	1	1	15			9
	Sept.	14	16	18	29	9	31
	Oct.	62	40	52	116	48	89
	Nov.	102	80	70	241	85	116
	Dec.	53	79	103	182	76	180
Totals		809	1,003	1,197	1,518	904	1,089
Asparagus	Jan						
	Feb.		6	10	1		
	Mar.	83	216	525	691	188	624
	April	247	346	567	563	636	913
	May	79	93	109	173	204	220
	June	49	54	67	64	118	84
	July		3	1		1	3
	Aug.						
	Sept.						
	Oct.				14	6	24
	Nov.				4	1	8
	Dec.						
Totals		458	718	1,279	1,510	1,154	1,876
Beans, green	Jan.						
	Feb.						
	Mar.		2				1
	April	3		18	32	1	27
	May	23	24	78	93	56	80
	June		6	5	4	2	7
	July						
	Aug.						
	Sept.						
	Oct.			1	2		
	Nov.			16	1		7
	Dec.					1	4
Totals		26	32	118	132	60	126

Table 13—Carlot Shipments of California Vegetables by Months—1923-1928—Continued

Crop		1923	1924	1925	1926	1927	1928
Cabbage	Jan.	23	61	50	146	54	35
	Feb.	69	57	44	155	68	56
	Mar.	186	62	79	179	90	193
	April	167	25	44	75	41	195
	May	194	104	208	61	77	287
	June	27	12	105	30	4	10
	July	2	9	46	5	4	.....
	Aug.	.....	11	2	5	1	.....
	Sept.	1	11	9	4	4	7
	Oct.	7	3	21	.....	2	12
	Nov.	2	2	31	3	.....	.....
	Dec.	5	13	5	14	3	16
Totals		683	370	644	677	348	811
Cantaloupes[1] (Imperial Valley)	Jan.	.....	.....	.....	.....	.....	.....
	Feb.	.....	.....	.....	.....	.....	.....
	Mar.	.....	.....	.....	.....	.....	.....
	April	.....	.....	.....	1	.....	.....
	May	797	1,213	1,477	5,772	1,738	4,281
	June	9,923	11,647	9,776	6,981	10,799	10,404
	July	2,271	3,060	2,716	1,243	5,151	3,719
	Aug.	8	13	13	10	275	105
	Sept.	.....	.....	.....	.....	.....	.....
	Oct.	.....	.....	.....	.....	6	90
	Nov.	.....	.....	.....	14	148	195
	Dec.	.....	.....	.....	1	4	1
Totals		12,999	15,933	13,982	14,022	18,121	18,795
Cantaloupes[1] (other districts)	Jan.	.....	.....	.....	.....	.....	.....
	Feb.	.....	.....	.....	.....	.....	.....
	Mar.	.....	.....	.....	.....	.....	.....
	April	.....	.....	.....	.....	.....	.....
	May	.....	.....	.....	.....	.....	.....
	June	.....	.....	30	60	.....	23
	July	932	1,718	1,611	2,013	1,101	2,431
	Aug.	1,597	1,618	1,810	1,136	1,749	2,416
	Sept.	603	426	682	597	983	1,202
	Oct.	314	222	402	360	391	369
	Nov.	48	16	115	73	61	34
	Dec.	.....	.....	18	2	.....	1
Totals		3,494	4,000	4,668	4,241	4,285	6,476
Carrots	Jan.	.....	19	47	68	255	355
	Feb.	.....	2	8	32	97	141
	Mar.	.....	11	12	41	228	168
	April	.....	3	34	107	243	489
	May	20	83	94	163	523	612
	June	3	37	64	125	678	330
	July	.....	2	6	6	25	4
	Aug.	.....	2	.....	2	2	26
	Sept.	.....	3	.....	.....	20	87
	Oct.	.....	1	1	17	109	389
	Nov.	1	.....	48	87	325	518
	Dec.	3	13	18	188	286	513
Totals		27	166	332	836	2,791	3,632
Cauliflower	Jan.	1,141	618	838	878	1,150	1,661
	Feb.	698	872	818	896	889	1,558
	Mar.	802	591	429	840	798	1,175
	April	92	83	213	230	485	769
	May	22	81	84	45	452	397
	June	17	6	5	.....	10	26
	July	7	.....	4	.....	.....	1
	Aug.	5	17	5	6	.....	.....
	Sept.	8	1	4	1	4	1
	Oct.	33	52	127	50	77	43
	Nov.	443	376	348	406	598	494
	Dec.	307	571	975	484	792	1,207
Totals		3,575	3,268	3,850	3,836	5,255	7,332

Table 13—Carlot Shipments of California Vegetables by Months—1923-1928—Continued

Crop		1923	1924	1925	1926	1927	1928
Celery	Jan.	1,157	1,108	963	1,466	2,176	2,365
	Feb.	516	422	386	506	623	683
	Mar.	229	434	360	361	777	759
	April	7	49	74	151	371	372
	May	3	65	191	145	424	642
	June	39	84	202	347	315	480
	July	34	55	77	126	112	231
	Aug.	18	6	4	49	30	55
	Sept.	2	2	3	8	2	36
	Oct.	85	72	124	83	90	278
	Nov.	905	860	1,317	920	1,043	1,302
	Dec.	1,532	1,362	1,638	1,862	1,645	2,231
Totals		4,527	4,519	5,339	6,024	7,607	9,434
Cucumbers	Jan.						
	Feb.						
	Mar.						
	April						
	May	23		2	22		4
	June	59	10	22	33	13	14
	July	8	7	14		6	
	Aug.	25	6	34	18		
	Sept.	9		30	2	4	
	Oct.	1		10		9	2
	Nov.			13	7	25	26
	Dec.				4	6	3
Totals		125	23	125	86	63	49
Lettuce (Imperial Valley)	Jan.	1,798	2,189	1,782	3,257	3,612	3,615
	Feb.	1,988	3,183	2,583	3,231	4,225	4,806
	Mar.	3,015	2,433	4,050	3,438	2,384	3,074
	April	570	1,127	1,086	430	72	2
	May						
	June						
	July						
	Aug.						
	Sept.						
	Oct.						
	Nov.				6		
	Dec.	616	365	806	730	367	578
Totals		7,987	9,297	10,307	11,092	10,660	12,075
Lettuce (other districts)	Jan.	155	67	142	42	28	62
	Feb.	55	2	80	10	9	11
	Mar.	212	28	43	116	66	142
	April	1,089	1,164	1,416	1,453	1,659	2,674
	May	1,410	1,952	2,410	2,953	3,258	4,949
	June	430	839	934	1,893	1,226	1,415
	July	395	380	640	1,176	1,282	1,372
	Aug.	507	203	505	584	1,397	1,496
	Sept.	296	280	695	1,244	1,714	1,862
	Oct.	450	1,094	1,843	2,970	2,949	3,195
	Nov.	1,241	2,065	1,838	2,425	2,719	3,566
	Dec.	886	1,109	765	1,443	607	627
Totals		7,126	9,183	11,311	16,309	16,914	21,371
Mixed vegetables	Jan.	428	335	600	575	590	898
	Feb.	411	330	415	520	519	619
	Mar.	547	319	475	518	699	627
	April	492	293	407	422	594	530
	May	414	407	482	376	632	573
	June	251	394	321	239	304	301
	July	283	303	232	307	200	179
	Aug.	242	247	198	224	223	157
	Sept.	179	217	189	216	196	133
	Oct.	171	214	293	433	257	307
	Nov.	479	533	655	580	517	682
	Dec.	440	692	606	721	538	734
Totals		4,337	4,284	4,873	5,131	5,269	5,740

Table 13—Carlot Shipments of California Vegetables by Months—1923-1928—Continued

Crop		1923	1924	1925	1926	1927	1928
Onions	Jan.	175	301	65	213	85	99
	Feb.	91	154	90	93	38	53
	Mar.	195	293	86	188	32	76
	April	57	114	35	87	97	83
	May	700	691	744	1,065	1,432	1,097
	June	340	658	295	452	525	435
	July	117	193	544	187	282	301
	Aug.	305	338	515	351	276	746
	Sept.	716	282	324	321	461	792
	Oct.	555	113	256	195	186	365
	Nov.	334	66	247	144	111	164
	Dec.	215	48	112	140	130	97
Totals		3,800	3,251	3,313	3,436	3,655	4,308
Peas, green[2]	Jan.				4		27
	Feb.				13	25	67
	Mar.			204	110	342	366
	April			135	208	179	354
	May			73	75	262	226
	June			4	33	27	20
	July			6	25	2	
	Aug.			7	22	11	
	Sept.			8	14	93	50
	Oct.			14	57	110	101
	Nov.			227	230	217	277
	Dec.			94	41	93	148
Totals				772	832	1,361	1,636
Peppers	Jan.						
	Feb.						
	Mar.					1	
	April						
	May						
	June		1				12
	July	1				1	
	Aug.						
	Sept.	1	5	1	8		5
	Oct.	6	25	40	47	12	24
	Nov.	12	1	20	37	17	5
	Dec.				7	4	
Totals		20	32	61	99	35	46
Potatoes	Jan.	739	437	532	501	412	688
	Feb.	544	258	343	298	263	558
	Mar.	420	153	210	186	103	282
	April	201	44	125	114	109	127
	May	152	111	177	400	151	445
	June	787	549	574	1,364	882	974
	July	717	784	848	771	929	607
	Aug.	637	823	1,019	949	1,173	684
	Sept.	854	956	976	1,043	1,041	785
	Oct.	706	788	677	736	745	836
	Nov.	538	709	334	542	744	677
	Dec.	470	635	354	450	661	667
Totals		6,765	6,247	6,169	7,354	7,213	7,330
Spinach	Jan.	23	3	16	49	25	14
	Feb.	12	2	18	11	11	20
	Mar.	93	13	118	47	97	197
	April	325	37	57	100	212	78
	May		13			34	2
	June			5			
	July			1			
	Aug.						
	Sept.				1		1
	Oct.				8		2
	Nov.	1		41	55	2	29
	Dec.	1	26	47	12	17	46
Totals		455	94	303	283	398	389

Table 13—Carlot Shipments of California Vegetables by Months—1923-1928—Continued

Crop		1923	1924	1925	1926	1927	1928
Strawberries	Jan.						
	Feb.						
	Mar.		1	5	8	2	
	April	21	73	36	56	32	45
	May	171	116	89	40	143	113
	June					5	
	July	2	1				1
	Aug.	32					
	Sept.						
	Oct.						
	Nov.						
	Dec.						
Totals		226	191	130	104	182	159
Tomatoes	Jan.	3		1	1		
	Feb.				1		
	Mar.						
	April			1	11	1	6
	May	97	42	53	190	83	214
	June	183	89	100	127	151	242
	July	178	137	104	126	137	219
	Aug.	268	205	106	177	71	221
	Sept.	902	697	457	1,001	719	791
	Oct.	1,146	1,105	1,608	2,007	2,753	1,848
	Nov.	497	475	472	712	649	861
	Dec.	22	38	59	70	11	21
Totals		3,296	2,788	2,961	4,423	4,575	4,423
Watermelons	Jan.						
	Feb.						
	Mar.						
	April						
	May	26	15	82	359	53	233
	June	1,232	1,079	1,616	2,945	1,683	2,171
	July	1,435	1,975	1,748	2,333	2,474	2,490
	Aug.	848	915	788	594	808	490
	Sept.	407	291	227	128	170	185
	Oct.	104	30	59	5	33	23
	Nov.	2		2			1
	Dec.						
Totals		4,054	4,305	4,522	6,364	5,221	5,593
Grand totals, all vegetables		64,789	69,704	76,256	88,309	96,071	112,672

[1] Includes straight cars of cantaloupes, honeydews, honeyballs, Persians, casabas, and cars of mixed melons.

[2] Shipments of peas prior to 1925 not available.

VEGETABLE IMPORTS FROM MEXICO

The development of vegetable acreages in Mexico and the rapidly increasing importations is of importance to California growers.

Table 14 gives the carlot shipments of the important vegetables by months for the years 1923 to 1928, inclusive. Besides the commodities listed imports for 1928 included 24 cars watermelons, 4 cars string beans, 1 car cucumbers, and 1 car of potatoes. Tomatoes, of which there were 4046 cars imported, arrive during the winter and spring months. Mexico ships heaviest of green peas during the month of February but the movement continues through March. Total shipments of green peas amounted to 1066 cars.

Table 14—Carlot Imports of Specified Vegetables from Mexico into the United States by Months, 1923-1928

Crop		1923	1924	1925	1926	1927	1928
Cantaloupes[1]	Jan.						
	Feb.						
	Mar.		1				1
	April	2	63		36	4	18
	May	99	50	140	265	48	185
	June			38		17	27
	July						
	Aug.						
	Sept.						
	Oct.						
	Nov.		3				
	Dec.		7				
Totals		101	124	178	301	69	231
Mixed Vegetables	Jan.	10	3	11	32	9	24
	Feb.	2	19	30	60	15	29
	Mar.	27	21	8	25	4	43
	April	17	82	25	32	12	34
	May	11	31	7	4	12	11
	June		3	1		3	
	July						
	Aug.						
	Sept.						
	Oct.						
	Nov.	3					1
	Dec.		1	2	1		19
Totals		70	160	84	154	55	161
Peas, green[2]	Jan.				159	181	253
	Feb.				243	521	503
	Mar.				139	145	154
	April			9	5	3	2
	May						
	June						
	July						
	Aug.						
	Sept.						
	Oct.						
	Nov.					1	6
	Dec.			53	61	74	148
Totals				62	607	925	1,066

Table 14—Carlot Imports of Specified Vegetables from Mexico into the United States by Months, 1923-1928—Continued

Crop		1923	1924	1925	1926	1927	1928
Peppers[2]	Jan.				45	77	75
	Feb.				29	176	190
	Mar.				27	77	78
	April				57	54	43
	May				8	21	42
	June					3	
	July						
	Aug.						
	Sept.						
	Oct.						
	Nov.				1		1
	Dec.			26	11	6	31
Totals				26	178	414	460
Tomatoes	Jan.	214	71	266	447	452	443
	Feb.	383	91	300	582	1,063	339
	Mar.	414	278	483	845	1,306	1,220
	April	472	728	1,136	654	1,406	1,507
	May	291	660	522	320	285	9
	June	3	60	19	17		
	July						
	Aug.			1			
	Sept.						
	Oct.						
	Nov.			4	7	37	41
	Dec.	16	50	151	277	267	487
Totals		1,793	1,938	2,882	3,149	4,816	4,046
Grand totals		1,964	2,222	3,232	4,389	6,279	5,964

[1] Includes honeydews.
[2] 1925 shipments incomplete. No data available prior to 1925.

CANNED VEGETABLES

Table 15 gives the yearly pack of the principal vegetables canned in California from 1900 to 1928, inclusive. This table was prepared from data compiled by the California Fruit News and the Canners League of California. There were no data available on spinach prior to 1919 or on string beans prior to 1906. These products are included in "Other Vegetables" where not listed separately. No data were available on tomato products before 1917, but presumably "Tomatoes" included tomato products prior to that year.

Table 15—Comparative Packs of Canned Vegetables, California
(Number of cases, all grades and sizes)

Year	Asparagus, cases	Beans, string, cases	Peas, cases	Spinach, cases	Tomatoes, cases	Tomato products, cases	Other vegetables, cases	Total cases
1900	143,861	.....	57,466	.....	266,550	.....	35,740	503,617
1901	187,592	.....	102,089	.....	748,440	.....	37,937	1,076,058
1902	227,126	.....	57,710	.....	827,052	.....	39,380	1,151,268
1903	256,220	.....	70,487	.....	958,295	.....	58,572	1,343,574
1904	224,877	.....	71,233	.....	566,114	.....	99,559	961,783
1905	228,439	.....	56,170	.....	834,571	.....	73,285	1,192,465
1906	295,890	60,800	142,400	.....	1,376,500	.....	86,250	1,961,840
1907	175,300	85,740	58,655	.....	1,732,120	.....	134,835	2,186,650
1908	238,755	40,920	95,250	.....	1,199,550	.....	34,850	1,609,325
1909	411,595	14,380	119,660	.....	777,220	.....	47,750	1,370,605
1910	620,500	50,890	194,695	.....	1,540,745	.....	88,995	2,495,825
1911	689,170	78,530	206,980	.....	1,724,810	.....	87,515	2,787,005
1912	723,500	92,020	287,575	.....	1,845,300	.....	124,440	3,072,835
1913	729,350	97,125	100,770	.....	1,303,570	.....	174,055	2,404,870
1914	775,585	86,270	174,870	.....	2,106,350	.....	149,415	3,292,490
1915	809,860	98,220	209,399	.....	1,344,085	.....	145,650	2,607,214
1916	990,740	123,385	227,120	.....	2,647,300	.....	236,525	4,225,070
1917	965,708	169,326	472,670	.....	3,346,104	1,356,755	637,206	6,947,769
1918	902,236	155,123	265,970	.....	3,884,973	1,809,805	1,267,713	8,285,820
1919	1,031,269	154,278	191,564	476,866	3,809,979	885,906	501,657	7,051,519
1920	1,024,813	99,269	366,679	685,228	1,858,822	833,019	382,116	5,249,946
1921	887,030	97,815	86,074	434,068	357,092	495,101	258,767	2,615,947
1922	1,239,839	150,988	473,260	1,180,525	1,925,389	1,498,617	444,753	6,913,371
1923	1,519,756	96,793	223,923	1,383,831	2,924,909	1,283,198	368,425	7,800,835
1924	1,792,769	146,993	242,295	1,072,893	2,155,453	1,292,273	436,083	7,138,759
1925	1,744,999	131,346	270,727	1,805,537	2,259,314	1,790,127	525,841	8,527,891
1926	2,236,111	31,431	216,511	1,339,357	3,190,822	2,126,105	406,938	9,547,275
1927	2,189,570	113,708	52,914	1,968,668	2,913,864	1,097,423	393,233	8,729,380
1928	2,337,950	118,958	124,677	2,904,542	2,275,610	2,061,680	650,949	10,474,366

FRUIT CROPS

The latest revised estimates of production and farm value relating to the main fruit crops of California for the years 1924 to 1928, inclusive, are shown in Table 16. In other tables, and the discussion that follows, are given more details and additional information.

Apples—The 1928 apple crop was the largest ever produced and amounted to 13,105,000 boxes. The commercial production, or that part of the crop sold for fresh consumption, was estimated at 6,861,000 boxes. In 1927 there were 4,656,000 boxes so utilized. The production of Gravensteins, the most important summer variety, was large, being estimated at 95 per cent of normal. In the Watsonville area, the crop of Bellefleurs was good and that of Newton Pippins was exceptionally heavy. Southern California produced about 75 per cent of a full crop. Rome Beauties, Winesaps and Delicious are the important varieties in that section. Carlot shipments of all apples to April 27, 1929, totaled 6214 cars compared with 3922 to the same date last year. Total shipments for the 1927 crop amounted to 4026 cars. Truck shipments are continuing to increase and it is estimated that approximately 1,185,000 boxes moved to market in that manner. On account of a rather favorable dried market, more than the usual percentage of the crop was sent to driers. The dried tonnage amounted to 16,310 tons compared with 6250 tons the year previous. From present information on plantings, the increase in the bearing acreage will be but slight during the next four years.

Peaches—A final check of the 1928 crop of peaches showed a total production of 618,000 tons of all varieties. There were 414,000 tons of Clingstone peaches produced in 1928, of which 322,000 tons were canned, 22,000 tons shipped to out of state markets and consumed fresh within the state, and about 70,000 tons wasted. In 1927 there were 322,000 tons of Clingstones produced, of which 230,000 tons were canned, 27,000 tons shipped to eastern markets or used in the fresh state throughout California, and about 65,000 tons wasted. The production of Freestone peaches amounted to 204,000 tons in 1928, of which 155,000 tons were utilized for drying, 3800 tons canned and 45,200 tons used locally and shipped to out of state markets. In 1927 the total production of Freestones amounted to 170,000 tons, of which 95,000 tons were used for drying, 7500 tons canned, and 65,500 tons consumed locally and sent to out of state markets. Unless abnormal conditions prevail, the bearing acreage of Cling peaches will probably reach its peak in 1931, when it is expected to be about 6 per cent above that of the past season. Indications point to a slight decrease in the bearing acreage of Freestone peaches, as plantings the past few seasons have been comparatively light.

Pears—The 1928 California pear crop was the heaviest on record. It amounted to 224,500 tons, of which about 89 per cent were Bartletts, and 11 per cent fall and winter varieties. Reports indicate that there were 61,500 tons of pears canned from the 1928 crop, 115,000 tons shipped to out of state markets, and 48,000 tons dried or consumed fresh locally. This may be compared with 51,000 tons canned from the 1927 crop, 98,000 tons shipped out of the state, and 32,000 tons dried or consumed fresh locally. In addition to the tonnage harvested in 1927 and 1928, there were a few thousand tons wasted each year, largely on account of low prices and poor quality. Based upon plantings the past few seasons,

and should normal conditions prevail, it is expected that by 1932 the bearing acreage of pears will be about 32 per cent larger than it was in 1928.

Apricots—There were 175,000 tons of apricots produced in California during 1928. This was about an average production. Out of the 1928 crop, 38,000 tons were canned, 122,000 tons were used in drying, and 15,000 tons shipped east or consumed fresh within the state. This may be compared with 57,000 tons canned from the 1927 crop, 137,000 tons used for drying, and 14,000 tons shipped east or consumed fresh within the state. The production was uniformly fair throughout the state with the exception of Ventura County, where the crop was exceptionally light. An increase of about 7 per cent is expected in the bearing acreage of apricots during the next four years.

Prunes—California again produced a good crop of prunes in 1928. It amounted to 220,300 tons, which is only about 5000 tons under the production of the previous year. Yields were comparatively good in all of the principal producing sections. There will probably be an increase of about 5 per cent in the bearing acreage by 1932.

Plums—A final check on the 1928 crop indicates that 66,000 tons of plums were harvested. This is slightly under the actual production as the small sized fruit of some varieties was kept off the market. The tonnage of plums shipped from California the past season totaled 56,000 tons, while in 1927 it amounted to 49,000 tons. Canners utilized 2900 tons in 1928 compared with 2300 tons in 1927. It is estimated that by 1932 the bearing acreage of plums will be about 9 per cent above that of the past season.

Cherries—The production of cherries was quite heavy in 1928 and amounted to 18,500 tons. As nearly as can be determined, about 38 per cent were of the white or canning varieties (practically all Royal Ann), and 62 per cent of the black or shipping varieties. In 1927, the total production amounted to 12,000 tons and the two classes each made up about one half of the crop. There were canned in 1928, exclusive of the cherries processed, 4670 tons compared with 2850 in 1927. The shipments out of the state in 1928 amounted to 7080 tons, while in 1927 the amount totaled 4632 tons. The bearing acreage of cherries has been increasing steadily and will continue to do so for the next four years.

Grapes—The total production of fresh grapes of all varieties in 1928 was 2,366,000 tons. Early prospects were unusually favorable but the outlook declined as the season advanced. This decline was brought about by a combination of factors. The rainfall in the winter and spring of 1928 was below normal, there was a short supply of gravity water for summer irrigation and high temperatures were prevalent throughout the interior valleys the first half of August which caused considerable sunburn and a partial raisining of some grapes on the vines. From 1919 to 1928 the bearing acreage of all grapes increased from 322,000 to 653,483. The nonbearing acreage of grapes at the present time is not large enough to maintain the present bearing acreage. Therefore, it is estimated that by 1931 the bearing acreage of all varieties will be about 628,700 acres.

A part of the California grape crop has been left unharvested the past few seasons. The following table gives estimates by classes of the tonnage left on the vines:

	1925	1926	1927	1928
	Tons	Tons	Tons	Tons
Raisin grapes	38,000			60,000
Table grapes	100,000	15,000	142,000	75,000
Wine grapes				18,000
Totals	138,000	15,000	142,000	153,000

The total production of raisin grapes on a fresh basis was 1,406,000 tons. Out of this total, 302,000 tons were used for by-products or consumed fresh, and 1,044,000 tons were dried, producing an equivalent of 261,000 tons of raisins. As nearly as can be determined about 6000 tons of dried raisins of the 1928 crop were used for stock feed. In 1927, the total production amounted to 1,443,000 tons, of which 303,000 tons were used for by-products or consumed fresh, and 1,140,000 tons were dried, making 285,000 tons of raisins. The 1928 crop of Thompson Seedless was a little above that of the year before, but that of Muscats somewhat less.

There have been practically no plantings of grapes of the raisin class the past two years. For that reason, a continued decline in the bearing acreage can be expected.

It was estimated that the total production of table grapes amounted to 478,000 tons compared with 490,000 tons in 1927. The Malaga crop was short compared with the year previous. There was very little difference in the yield of Tokays but a larger percentage of the crop was harvested in 1928. The Emperor crop was heavy, being considerably above that of 1927. Recent plantings of table grapes have also been very light and the bearing acreage will in all probability decline the next few years.

From a check on the disposition of the crop, it was estimated that 482,000 tons of grapes of strictly wine varieties were produced. In 1927 the wine grape crop amounted to 473,000 tons. There was very little difference in the production of Zinfandels the past two seasons. The quality in 1928 was poor, however, and as a result less tonnage was shipped east but more tonnage dried or used locally for by-products. Alicante production was slightly better than in 1927, while the combined production of all other wine varieties was about the same. The bearing acreage of wine grapes is expected to continue to increase the next three years, as plantings have been more than sufficient to maintain the present bearing acreage.

Oranges—A final check on shipments of oranges from the 1927-28 crop, plus the tonnage consigned to by-product factories and otherwise utilized, shows a total production of 23,000,000 boxes. About 53 per cent of the production was Navels and 47 per cent Valencias. The 1928-29 crop is by far the heaviest ever produced and promises to reach 33,000,000 boxes. Although the yield of both Navels and Valencias is heavy, Valencias will this year account for more than half of the orange crop.

A small increase is expected in the bearing acreage of all oranges during the next few years. This increase will be confined to Valencias entirely as the nonbearing acreage of Navels is quite small.

Grapefruit—The production of grapefruit has been growing yearly, due primarily to the increased production in the Imperial and Coachella valleys. Furthermore, it will continue to increase as plantings in these two valleys have been quite large the past few years. It is estimated that the 1927-28 crop of grapefruit in the state amounted to 720,000 boxes. From present indications the crop of 1928-29 will approximate 800,000 boxes.

Lemons—The final check on the disposition of the 1927-28 lemon crop indicates a total production of about 6,000,000 boxes. It is estimated that the 1928-29 crop will be close to 7,100,000 boxes. The nonbearing acreage of lemons is quite small. Therefore, it is expected that the trend of the bearing acreage will be downward during the next four years.

Avocados—Approximately 42,500 boxes (15 pounds net weight) of avocados were harvested from the 1927-28 crop. It is expected that the 1928-29 harvest will amount to 267,000 boxes, which is by far the heaviest crop ever produced. Plantings during the past few years have been heavy and although some of them may never be a factor in production, there is no question but what the crop will continue to increase for some time. In 1928 it was estimated that 30 per cent of the avocado acreage was bearing and 70 per cent nonbearing.

Persimmons—The 1928 crop was estimated at 2239 tons, over 80 per cent of which was produced in southern California. Production has been increasing and will continue to do so as last year only 30 per cent of the total acreage was regarded as bearing. Net returns have been quite satisfactory with the exception of 1928, when the growers averaged only forty dollars per ton. The average return for the past five years is slightly above eighty-seven dollars per ton.

Pomegranates—Tulare County is the only district in the state where the pomegranate industry is of commercial importance. According to available information, an average of around 2000 tons have been packed and shipped the past four years. This represents about one half of the crop, as only the high quality fruit is packed. The other half is either wasted or used for juice purposes. Returns to the growers for that part of the crop packed have not been entirely satisfactory, as the average for the past four years has been about twenty dollars per ton.

Dates—The total production of dates of all varieties amounted to about 2,000,000 pounds or 1000 tons in 1928. This is a substantial increase over the crop of 1927 and about 100 per cent above the production of five years ago. No reliable data is available on the annual average net return per pound for all varieties. The Deglet Noor is the most important variety and now makes up between 65 and 70 per cent of the total crop. This variety has probably brought the grower an average of about sixteen cents per pound during the past four years. There are 1963 acres planted to edible dates of all varieties in California. Out of this total, about 40 per cent are bearing and 60 per cent nonbearing.

Figs—The total production of dried figs in 1928 was 10,900 tons, which may be compared with 12,000 tons in 1927. Adriatics and Black Missions produced fair crops, but Calimyrnas were very light on account of the Endosepsis campaign. The quality of the dried fig crop was again poor and growers were able to market only 8366 tons compared with 9286 the previous year. The unmarketable part of the crop was used locally for stock feed or by-products.

Fig growers will be interested in the following table showing the tonnage of Calimyrna and Kadota figs canned and preserved since 1922, with an estimate of the tonnage of figs of all varieties consumed fresh the past five years:

Year	Canned			Fresh consumption (estimated), tons	Total canned and consumed fresh, tons
	Calimyrna, tons	Kadota, tons	Total canned tons		
1922	1,396	341	1,737		
1923	1,619	547	2,366		
1924	610	325	935	1,200	2,135
1925	400	1,025	1,425	1,650	3,075
1926	400	2,568	2,968	2,132	5,100
1927	370	2,730	3,100	2,300	5,400
1928	131	3,999	4,130	2,000	6,130

Olives—As nearly as can be determined at the present time, there were about 21,500 tons of olives harvested in California in 1928, which is the same as the tonnage harvested in 1927. According to reports, about 11,100 tons of ripe olives were canned from the 1927 crop. Although final figures are not yet available on the pack from the 1928 crop, it is estimated to be about the same as for the previous year. During the past two seasons, about one half of the harvested tonnage has been canned. The remainder has been shipped fresh, home pickled, salt cured, and used in the manufacture of olive oil. Very little change is expected in the bearing acreage of olives during the next four years.

Almonds—The production of almonds amounted to 13,700 tons. Total yields in the various localities were about the same for the two years with the exception of the Paso Robles district where the production was the heaviest on record. As far as the crop by varieties is concerned, the 1928 yield of each of the following; Ne Plus, I. X. L. and Nonpareil, was above that of last year, while that of Texas and Drake was less. No increase is expected in the bearing acreage of almonds during the next four years.

Walnuts—California produced 25,000 tons of walnuts in 1928, which may be compared with a yield of 51,000 tons in 1927. Out of the 1928 crop about 21,000 tons were of sufficiently high quality to be marketed in the shell and 4000 tons were diverted to cracking plants and marketed as walnut meats. In 1927, about 42,000 tons were sold in the shell while 9000 tons were cracked and used for walnut meats. Last year in southern California, where normally 90 per cent of the crop is produced, the average yield was light as some districts were affected by delayed foliation. The yield in northern California was comparatively good. A substantial increase in the bearing acreage is forecast for the next four years.

Table 16—Production and Value of Specified Fruit Crops, 1924-1928

Crop		Production	Unit	Farm value, December 1	
				Per unit	Total
Apples	1928	13,105,000	Boxes	$0 50	$6,553,000
	1927	7,458,000	Boxes	0 90	6,712,000
	1926	10,350,000	Boxes	0 40	4,140,000
	1925	6,016,000	Boxes	1 15	6,918,000
	1924	8,903,000	Boxes	1 22	10,862,000
5-year average (1924-1928)		9,166,400	Boxes	0 77	7,037,000
Pears	1928	224,500	Tons	37 50	8,419,000
	1927	181,000	Tons	54 00	9,774,000
	1926	207,000	Tons	35 00	7,245,000
	1925	181,000	Tons	52 00	9,412,000
	1924	133,000	Tons	66 00	8,778,000
5-year average (1924-1928)		185,300	Tons	47 09	8,726,000
Peaches	1928	548,000	Tons	23 00	12,604,000
	1927	427,000	Tons	25 00	10,675,000
	1926	541,000	Tons	39 00	21,099,000
	1925	394,000	Tons	36 00	14,184,000
	1924	330,000	Tons	35 00	11,550,000
5-year average (1924-1928)		448,000	Tons	31 30	14,022,000
Apricots	1928	175,000	Tons	50 00	8,750,000
	1927	208,000	Tons	57 00	11,856,000
	1926	176,000	Tons	63 00	11,088,000
	1925	150,000	Tons	54 00	8,100,000
	1924	142,000	Tons	46 00	6,532,000
5-year average (1924-1928)		170,000	Tons	54 50	9,265,000
Prunes	1928	220,300	Tons	100 00	22,030,000
	1927	225,000	Tons	70 00	15,750,000
	1926	150,000	Tons	100 00	15,000,000
	1925	146,000	Tons	110 00	16,060,000
	1924	139,000	Tons	110 00	15,290,000
5-year average (1924-1928)		176,000	Tons	95 60	16,826,000
Plums	1928	66,000	Tons	37 00	2,442,000
	1927	57,000	Tons	45 00	2,565,000
	1926	71,000	Tons	25 00	1,775,000
	1925	51,000	Tons	40 00	2,040,000
	1924	39,000	Tons	45 00	1,755,000
5-year average (1924-1928)		56,800	Tons	37 24	2,115,000
Cherries	1928	18,500	Tons	150 00	2,775,000
	1927	12,000	Tons	180 00	2,160,000
	1926	20,000	Tons	180 00	3,600,000
	1925	12,000	Tons	160 00	1,920,000
	1924	13,500	Tons	140 00	1,890,000
5-year average (1924-1928)		15,200	Tons	162 43	2,469,000
Raisins, dried	1928	261,000	Tons	40 00	10,440,000
	1927	285,000	Tons	60 00	17,100,000
	1926	272,000	Tons	70 00	19,040,000
	1925	200,000	Tons	80 00	16,000,000
	1924	170,000	Tons	70 00	11,900,000
5-year average (1924-1928)		237,600	Tons	62 69	14,896,000

Table 16—Production and Value of Specified Fruit Crops, 1924-1928—Continued

Crop		Production	Unit	Farm value, December 1	
				Per unit	Total
Raisin grapes (marketed fresh)	1928	[2]302,000	Tons	$10 00	$3,020,000
	1927	303,000	Tons	23 00	6,969,000
	1926	229,000	Tons	20 00	4,580,000
	1925	[2]378,000	Tons	20 00	7,560,000
	1924	180,000	Tons	20 00	3,600,000
5-year average (1924-1928)		278,400	Tons	18 48	5,146,000
Grapes, table	1928	[2]403,000	Tons	26 00	10,478,000
	1927	[2]348,000	Tons	26 00	9,048,000
	1926	[2]383,000	Tons	25 00	9,575,000
	1925	[2]339,000	Tons	20 00	6,780,000
	1924	325,000	Tons	40 00	13,000,000
5-year average (1924-1928)		359,600	Tons	27 19	9,776,000
Grapes, wine	1928	[2]464,000	Tons	25 00	11,600,000
	1927	473,000	Tons	45 00	21,285,000
	1926	414,000	Tons	45 00	18,630,000
	1925	395,000	Tons	60 00	23,700,000
	1924	350,000	Tons	63 00	22,050,000
5-year average (1924-1928)		419,200	Tons	46 41	19,453,000
Oranges	1928	33,000,000	Boxes	[3]2 25	74,250,000
	1927	23,000,000	Boxes	4 00	92,000,000
	1926	28,167,000	Boxes	3 05	85,909,000
	1925	24,200,000	Boxes	2 84	68,728,000
	1924	18,100,000	Boxes	3 55	64,255,000
5-year average (1924-1928)		25,293,000	Boxes	3 05	77,028,000
Lemons	1928	7,100,000	Boxes	[3]2 50	17,750,000
	1927	6,000,000	Boxes	3 80	22,800,000
	1926	7,712,000	Boxes	2 81	21,671,000
	1925	7,316,000	Boxes	2 11	15,437,000
	1924	5,125,000	Boxes	3 48	17,835,000
5-year average (1924-1928)		6,651,000	Boxes	2 87	19,099,000
Grapefruit	1928	800,000	Boxes	3 50	2,800,000
	1927	720,000	Boxes	3 80	2,736,000
	1926	650,000	Boxes	3 05	1,983,000
	1925	600,000	Boxes	2 84	1,704,000
	1924	387,000	Boxes	3 55	1,374,000
5-year average (1924-1928)		631,000	Boxes	3 36	2,119,000
Persimmons	1928	2,239	Tons	40 00	90,000
	1927	1,024	Tons	130 00	133,000
	1926	404	Tons	124 00	50,000
	1925	729	Tons	96 00	70,000
	1924	450	Tons	176 00	79,000
5-year average (1924-1928)		969	Tons	86 69	84,000
Avocados	1928	267,000	15 lb. box	[3]2 00	534,000
	1927	42,500	15 lb. box	5 30	225,000
	1926	83,300	15 lb. box	3 00	250,000
	1925	31,100	15 lb. box	4 05	126,000
	1924	17,250	15 lb. box	4 60	79,000
5-year average (1924-1928)		88,230	15 lb. box	2 75	243,000

Table 16—Production and Value of Specified Fruit Crops, 1924-1928—Continued

Crop		Production	Unit	Farm value, December 1	
				Per unit	Total
Figs, dried	1928	10,900	Tons	$45 00	$491,000
	1927	12,000	Tons	45 00	540,000
	1926	11,350	Tons	95 00	1,078,000
	1925	9,600	Tons	110 00	1,056,000
	1924	8,500	Tons	100 00	850,000
5-year average (1924-1928)		10,470	Tons	76 70	803,000
Figs, canned and marketed fresh	1928	[4]6,130	Tons	87 00	533,000
	1927	[4]5,400	Tons	100 00	540,000
	1926	[4]5,100	Tons	112 00	571,000
	1925	[4]3,075	Tons	100 00	308,000
	1924	[4]2,135	Tons	104 00	222,000
5-year average (1924-1928)		4,368	Tons	99 59	435,000
Olives	1928	21,500	Tons	80 00	1,720,000
	1927	21,500	Tons	80 00	1,720,000
	1926	12,000	Tons	80 00	960,000
	1925	14,000	Tons	60 00	840,000
	1924	6,500	Tons	92 00	598,000
5-year average (1924-1928)		15,100	Tons	77 35	1,168,000
Almonds	1928	13,700	Tons	340 00	4,658,000
	1927	12,000	Tons	320 00	3,840,000
	1926	16,000	Tons	300 00	4,800,000
	1925	7,500	Tons	400 00	3,000,000
	1924	8,000	Tons	300 00	2,400,000
5-year average (1924-1928)		11,440	Tons	326 92	3,740,000
Walnuts	1928	25,000	Tons	420 00	10,500,000
	1927	51,000	Tons	330 00	16,830,000
	1926	15,000	Tons	480 00	7,200,000
	1925	36,000	Tons	440 00	15,840,000
	1924	22,500	Tons	460 00	10,350,000
5-year average (1924-1928)		29,900	Tons	406 15	12,144,000

[1] Harvested tonnage only. See paragraph on peaches, page 799.
[2] Harvested tonnage only. See paragraph on grapes, page 800.
[3] Based principally on sales to date subject to revision at end of season.
[4] See paragraph on figs, page 802.

FRESH FRUIT SHIPMENTS, DRIED FRUITS, CANNED FRUITS

Many inquiries are being received yearly relative to the shipment of fresh fruits out of the state; the tonnage of dried fruits and the pack of canned fruit. To properly answer such inquiries and also as a matter of record, the following tables have been prepared.

Table 17—Interstate Shipments of California Deciduous Fruits in Carlots, 1895 to 1928, Inclusive
(All classes of equipment)

Year	Apricots	Cherries	Figs	Grapes	Peaches	Pears	Plums	Miscellaneous	Total
1895[1]	162	180	.....	1,010	1,289	1,187	465	275	4,568
1896[1]	172	88	2	712	976	1,624	407	71	4,052
1897[1]	177	239	3	1,100	1,316	1,640	742	106	5,323
1898[1]	123	297	.....	734	1,103	1,595	542	613	5,007
1899[1]	90	85	.....	847	2,625	1,684	885	653	6,869
1900[1]	152	238	.....	825	1,361	2,115	1,158	586	6,435
1901[1]	201	110	.....	966	1,901	1,535	936	810	6,459
1902[1]	222	245	.....	1,033	1,777	2,011	1,473	375	7,136
1903[1]	241	211	.....	1,804	1,857	1,719	1,145	693	7,670
1904[1]	97	209	.....	1,451	559	2,186	1,053	71	5,626
1905[1]	279	79	.....	1,602	1,946	1,013	1,391	1,914	8,224
1906[1]	16	150	.....	2,052	584	1,513	1,220	770	6,305
1907[1]	71	98	.....	3,460	699	1,039	1,039	1,085	7,491
1908[1]	232	208	.....	3,816	1,980	2,702	1,763	15	10,716
1909[1]	208	250	.....	5,875	2,599	2,638	1,527	20	13,117
1910[1]	290	250	.....	4,948	2,518	2,361	1,552	17	11,936
1911[1]	223	216	.....	6,375	2,027	2,325	1,366	16	12,548
1912[1]	196	244	.....	6,358	1,621	3,135	1,775	15	13,344
1913[1]	170	231	.....	6,363	2,396	2,486	1,668	18	13,332
1914[1]	382	166	.....	8,773	2,144	2,725	1,907	49	16,146
1915[1]	392	205	.....	9,563	1,689	2,646	2,225	58	16,778
1916[1]	289	164	.....	9,722	1,910	3,701	1,999	106	17,891
1917[1]	403	330	.....	13,944	2,432	4,802	2,651	66	24,628
1918[1]	441	356	.....	16,358	3,137	4,572	2,483	75	27,422
1919[1]	419	335	4	19,018	2,774	4,248	2,918	49	29,765
1920[1]	312	494	1	24,280	3,148	4,391	2,564	241	35,431
1921	348	665	13	30,200	3,453	4,384	3,113	257	42,433
1922	426	502	10	41,118	2,361	5,799	3,498	183	53,897
1923	719	602	20	52,209	3,702	7,251	5,247	189	69,939
1924	510	711	21	58,448	1,838	5,781	2,882	204	70,395
1925	403	512	43	71,099	2,960	7,787	3,709	269	86,782
1926	264	741	85	60,786	1,619	9,891	5,221	293	78,900
1927	471	579	116	73,094	4,663	8,146	4,117	288	91,474
1928	396	885	98	68,460	2,658	9,601	4,678	456	87,232

[1] Shipments from 1895 to 1920, inclusive, are from north of the Tehachapi only.

Table 17 presents data on the interstate shipments of deciduous fruit from California north of the Tehachapi, from 1895 to 1920, inclusive; and from all of California from 1921 to 1928, inclusive. Interstate shipments for southern California are not available prior to 1921. They were of minor importance before that time except for grapes and pears. Very few grapes, however, were shipped from southern California until 1918. The data for the early years were obtained from records compiled by the California Fruit News. The more recent data were supplied by the Pacific Fruit Express, Santa Fe Railway and the American Railway Express.

In Table 18 will be found estimates of the production of dried fruits and nuts. This table was prepared from data compiled by the Dried Fruit Association, California Packing Corporation, California Fruit News, and from the research studies of the economic status of certain California fruits by the University of California.

TABLE 18—Estimated Production of Dried Fruits and Nuts, California

Year	Apples, tons	Pears, tons	Peaches, tons	Apricots, tons	Prunes, tons	[1]Raisins, tons	Figs, tons	Almonds, tons	Walnuts, tons
1890	.....	300	.....	.....	8,000	19,000	.....	.....	.....
1891	1,400	500	6,600	6,750	13,750	26,000	180	.....	.....
1892	1,375	1,125	6,750	6,250	11,250	28,500	250	.....	.....
1893	1,900	1,320	8,400	4,750	26,090	42,500	450	.....	.....
1894	2,925	3,265	15,270	14,375	22,375	51,500	770	.....	.....
1895	2,280	2,700	12,250	5,325	32,375	45,500	1,375	.....	3,385
1896	1,175	4,825	8,230	3,370	27,600	34,000	1,080	.....	6,200
1897	2,625	3,175	13,575	15,067	48,890	47,000	1,625	.....	4,610
1898	1,760	3,310	5,480	4,120	45,210	40,500	2,390	450	5,650
1899	2,950	2,880	17,400	5,800	57,114	36,000	2,900	2,320	5,580
1900	3,180	7,275	17,170	14,040	87,000	47,000	3,000	2,740	5,430
1901	3,225	3,288	14,750	7,875	40,800	37,000	3,250	1,500	6,900
1902	4,875	2,625	25,200	18,750	98,500	54,000	3,600	3,270	8,570
1903	1,800	2,325	18,000	10,500	82,500	60,000	3,000	3,200	5,500
1904	1,500	1,750	11,500	8,500	67,500	40,000	2,850	800	7,590
1905	2,500	1,750	18,000	1,800	31,250	45,000	3,200	2,100	6,400
1906	2,500	1,500	10,000	3,000	92,500	50,000	3,000	750	7,000
1907	3,300	500	15,000	1,100	53,000	75,000	4,500	750	7,400
1908	3,350	2,500	23,000	19,000	28,500	65,000	2,900	2,900	9,200
1909	3,000	1,250	20,000	14,000	75,000	70,000	4,000	1,500	9,350
1910	3,000	1,000	25,000	15,250	40,000	62,500	3,775	3,300	9,600
1911	3,500	2,000	17,250	11,000	95,000	65,000	5,500	1,450	12,500
1912	3,600	1,750	29,000	20,000	102,500	95,000	5,000	3,000	11,250
1913	1,900	1,000	37,500	10,500	48,000	66,000	5,000	1,100	11,350
1914	4,500	1,500	35,100	20,500	56,000	91,000	6,500	2,250	8,900
1915	4,000	1,000	32,250	19,500	92,500	128,000	8,800	3,500	14,825
1916	4,500	800	28,000	11,000	78,500	132,000	9,900	3,400	14,600
1917	8,500	1,100	39,000	15,500	109,000	163,000	8,800	4,000	16,500
1918	6,250	1,000	20,000	15,000	45,000	167,000	9,200	5,100	19,950
1919	12,500	4,500	35,000	15,500	135,000	182,500	12,000	7,250	28,100
1920	5,500	2,700	27,000	9,500	97,250	177,000	12,300	5,500	21,000
1921	7,000	1,200	21,000	12,000	100,000	145,000	9,600	6,000	19,500
1922	10,500	5,000	28,000	15,500	110,000	237,000	11,000	8,500	27,000
1923	9,500	2,000	26,000	30,000	130,000	290,000	9,500	11,000	25,000
1924	10,000	3,150	24,500	16,000	139,000	170,000	8,500	8,000	22,500
1925	5,755	3,500	16,170	18,000	146,000	200,000	9,600	7,500	36,000
1926	10,500	4,250	28,200	18,800	150,000	285,000	11,350	16,000	15,000
1927	6,250	3,440	17,230	25,000	225,000	300,000	12,000	12,000	51,000
1928	16,310	5,570	28,183	22,120	220,300	268,000	10,900	13,700	25,000

[1] Figures on raisins include all classes of dried grapes.

The figures on raisins not only include Muscats, Thompsons, Sultanas and Currants, but all other dried grapes as well, such as Malagas, Zinfandels, and Feher Szagos.

The following figures show the production of raisins from 1872 to 1889, which was impossible to list in Table 18:

Year	[1]Production, tons	Year	[1]Production, tons
1872	60	1881	900
1873	60	1882	1,150
1874	90	1883	1,400
1875	110	1884	1,750
1876	190	1885	5,000
1877	320	1886	7,000
1878	480	1887	8,000
1879	650	1888	9,630
1880	750	1889	9,870

[1] Source of data, Gustav Eisen, "The Raisin Industry."

Table 19—Comparative Packs of Canned Fruits—California—1895 to 1928, inclusive

Cases	Apples, cases	Apricots, cases	Cherries, cases	Grapes, cases	Peaches, clingstone	Peaches, freestone	Pears, cases	Plums, cases	Total, cases
					All Peaches				
1895[1]	29,131	407,000	98,061	32,373	708,600		263,483	145,515	1,684,163
1896[1]	22,859	339,189	69,056	33,488	692,146		347,681	111,786	1,616,205
1897[1]	35,213	368,758	149,383	38,029	861,874		360,618	133,747	1,947,622
1898[1]	54,128	493,918	172,376	32,999	860,981		402,220	131,989	2,148,611
1899[1]	104,409	847,456	53,709	55,972	1,293,657		555,211	164,515	3,074,929
1900[1]	61,469	618,079	163,317	45,326	536,847	564,242	641,722	180,799	2,811,801
1901[1]	61,416	378,859	63,008	50,886	879,259	683,281	489,899	155,269	2,761,877
1902[1]	57,617	330,177	201,824	41,724	711,357	491,769	338,373	170,820	2,343,661
1903[1]	58,843	748,155	211,119	63,898	651,528	485,971	461,249	147,095	2,827,858
1904[1]	56,529	768,306	145,715	51,517	611,742	536,070	606,892	163,251	2,940,022
1905[1]	70,749	713,895	74,886	47,620	978,675	924,505	498,812	72,555	3,381,697
1906	138,450	456,950	161,950	121,850	740,000	990,250	612,500	224,100	3,446,050
1907	145,100	388,450	148,715	145,875	715,025	1,039,585	573,700	170,010	3,326,460
1908	69,300	1,286,900	212,310	53,470	1,414,870	1,112,300	669,600	270,350	5,089,100
1909	132,575	764,560	205,280	28,835	998,245	692,500	536,350	103,400	3,461,745
1910	147,380	941,790	215,210	52,005	1,560,050	944,650	670,585	95,170	4,626,840
1911	121,850	1,008,150	221,320	79,715	1,494,925	894,600	657,880	188,330	4,666,770
1912	151,000	1,023,235	384,455	53,410	1,791,235	686,940	916,050	201,590	5,207,915
1913	60,765	982,790	175,115	48,115	1,751,100	1,014,025	571,350	79,180	4,682,440
1914	177,635	1,335,235	115,155	56,160	2,918,035	1,092,200	862,055	131,480	6,687,955
1915	81,620	981,190	182,750	77,610	2,407,650	831,875	827,630	95,215	5,485,540
1916	213,525	1,327,770	168,785	101,130	2,597,390	1,202,940	1,032,810	84,750	6,729,100
1917	271,538	2,356,553	440,134	85,491	3,607,568	1,554,393	758,142	270,052	9,343,871
1918	167,705	2,233,314	360,090	99,068	3,122,458	1,393,595	811,950	148,577	8,336,757
1919	134,245	4,395,204	460,614	104,446	5,096,249	1,962,700	1,071,687	280,261	13,505,406
1920	9,041	2,312,020	647,977	114,886	5,205,511	1,547,687	1,184,288	164,740	11,186,150
1921	98,500	1,150,514	222,772	91,886	4,162,849	1,633,418	872,396	141,348	8,373,683
1922	3,749	3,569,918	557,591	69,760	7,844,912	1,314,597	1,712,773	182,270	15,255,570
1923	22,697	1,562,298	590,685	54,210	6,591,335	872,676	1,181,565	164,402	11,039,868
1924		2,050,405	215,114	79,980	5,366,598	963,621	1,444,623	90,675	10,211,016
1925		2,196,680	222,816	130,269	9,258,587	1,198,314	2,315,600	178,910	15,501,176
1926		3,390,418	526,520	119,338	13,654,758	817,319	2,044,414	228,750	20,781,517
1927		3,116,713	170,909	140,652	10,829,681	320,812	1,929,805	137,163	16,645,735
1928		2,097,070	280,126	93,247	14,811,606	163,830	2,336,593	173,564	19,956,036

[1] Figures from 1895 to 1905, inclusive, are calculated as no data on total packs by varieties are available.

In Table 19 is given the pack of canned fruits in California from 1895 to 1928, inclusive. This table was prepared from data compiled by the California Fruits News and the Canners' League of California. There were no data available on the total packs by varieties between 1895 and 1905. For those years the pack by varieties had to be calculated on a percentage basis and it is believed that the calculations represent fairly well the actual pack. The canned pack of the Pacific Northwest is becoming very important. Figures on the pack in that area as compiled by the Northwest Canners' Association will be found in Table 20.

Table 20—Comparative Packs of Canned Fruits—Pacific Northwest (Oregon, Washington, Idaho)—1919 to 1928, inclusive

Year	Apples, cases	Cherries, cases	Peaches, cases	Pears, cases	Plums, cases	Prunes, cases	Total, cases
1919	758,798	251,052	116	338,049	36,309	136,138	1,520,462
1920	352,758	353,861	.....	392,135	10,392	110,101	1,219,247
1921	948,135	211,783	.....	375,761	10,045	100,982	1,646,706
1922	632,656	357,596	1,190	833,521	15,860	263,341	2,104,164
1923	1,158,650	399,455	2,000	649,309	12,405	271,182	2,493,001
1924	1,171,250	380,632	1,144	751,290	23,127	115,516	2,442,959
1925	1,418,452	329,924	.....	1,275,844	36,300	269,242	3,329,762
1926	1,454,344	708,990	10,370	1,373,633	13,510	500,879	4,061,726
1927	1,237,038	359,114	.....	818,914	3,198	460,991	2,879,255
1928	2,210,203	634,041	.....	1,978,283	2,972	705,749	5,531,248

ESTIMATES OF CALIFORNIA FRUIT ACREAGES

The estimated acreage of California tree fruits in bearing for the 1929 season is 1,074,530 acres compared with 1,041,401 in bearing a year ago. This is an increase of 33,129 acres or 3.2 per cent. There has been a decrease in the total nonbearing acreage about equal to the increase in the bearing acreage. Plantings of tree fruits in 1928 amounted to 27,260 acres compared with 34,000 acres planted in 1927. Pears, apricots, Kadota figs, Valencia oranges, and walnuts make up the bulk of the new acreage planted. The estimated acreage of grapes of all varieties in bearing for the 1929 season is 639,927 acres. In 1928, the acreage in bearing was estimated to be 653,483 acres. This shows a decrease of 2.1 per cent. The nonbearing acreage of grapes is now quite small, amounting to only 13,131 acres and is made up mostly of wine grape varieties.

With the exception of freestone peaches, olives, table and raisin grapes, bearing acreages have increased compared with a year ago. The bearing acreage of cling peaches has increased but little however. As nearly as can be determined, there were about 4,900 acres of cling peaches removed the past winter, which is slightly less than the new acreage coming into bearing. Approximately 25 per cent of the acreage removed was in northern California, 52 per cent in central California, and 23 per cent in southern California. The acreage of the various varieties removed was: Tuscans, 2250; New Midsummers, 520; Old Midsummers, 200; Phillips, 1750; miscellaneous varieties, mostly Levi, 180. The total acreage of vines removed amounted to 20,270 acres. Out of the total, 1245 were wine grapes, 6949 table grapes, and 12,076 raisin grapes. There are probably about 1000 acres of table grapes and 3000 acres of raisin grapes not being cultivated this year which are included in the total bearing acreage.

Acreage estimates as given in Tables 24 to 32, inclusive, are segregated as to bearing and nonbearing relative to each county and for the state as a whole. The 1928 plantings of tree fruits are included in the county totals of nonbearing acreage. The different varieties of grapes have been arbitrarily arranged by classes in accordance with their general use rather than the methods of disposal during recent years.

In Table 22 is shown the estimated bearing acreage of the important tree fruits in California, 1919 to 1929, inclusive, and the bearing acreage of grapes by classes, 1919 to 1929, inclusive.

The survey of the peach acreage by age and variety completed three years ago has been enlarged, revised and continued and the results for the whole state are given in Table 34. Similar information is given separately for northern, central, and southern California in Tables 35 to 37, inclusive. A survey completed two years ago of the pear acreage by age and variety also has been revised and continued. The results are given in Table 38.

Table 21—Summary of California Tree Fruits and Grape Acreage, 1929

	Total bearing acreage, 1928	Total bearing acreage, 1929	Total nonbearing acreage	1928 plantings	Grand total, acreage
Apples	57,387	57,440	5,944	629	63,384
Peaches (clingstone)	75,717	76,012	10,565	1,425	86,577
Peaches (freestone)	62,138	60,692	6,744	1,990	67,436
Pears	62,471	69,461	24,620	2,326	94,081
Apricots	80,033	82,301	10,802	2,253	93,103
Plums	32,961	34,192	3,629	527	37,821
Prunes	171,945	176,647	14,217	646	190,864
Cherries	12,569	13,260	5,647	981	18,907
Figs (Kadotas)	42,128	7,118	7,648	3,267	14,766
Figs, all others		40,275	3,555	273	43,830
Olives	28,863	28,820	3,412	144	32,232
Grapefruit	7,828	8,993	5,183	1,663	14,176
Lemons	43,173	43,345	2,954	716	46,299
Oranges (Navels)	187,259	97,118	3,414	832	100,532
Oranges (Valencias)		91,358	20,892	3,925	112,250
Oranges (miscellaneous)		2,851	184	23	3,035
Almonds	89,384	91,713	5,398	703	97,111
Walnuts	83,252	87,564	39,921	3,022	127,485
Avocados	1,140	1,820	3,121	1,371	4,941
Pomegranates	1,570	1,588	23	1	1,611
Persimmons	879	1,208	1,929	335	3,137
Dates	704	754	1,209	208	1,963
Totals (tree fruits)	1,041,401	1,074,530	181,011	27,260	1,255,541
Wine grapes	176,187	180,891	10,078	4,793	190,969
Table grapes	138,857	132,886	2,525	951	135,411
Raisin grapes	338,439	326,150	528	73	326,678
Totals, grapes	653,483	639,927	13,131	5,817	653,058
Grand totals (fruits and grapes)	1,694,884	1,714,457	194,142	33,077	1,908,599

Table 22—Estimated Bearing Acreage of Tree Fruits and Grapes in California, 1919 to 1929, inclusive

	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Apples	46,731	46,931	49,898	51,754	52,857	53,772	55,458	56,343	57,106	57,387	57,440
Peaches	103,378	103,200	96,841	101,829	103,856	106,330	111,783	118,079	128,210	137,855	136,704
Pears	23,056	29,366	31,434	37,681	40,962	43,125	46,773	51,993	56,515	62,471	69,461
Apricots	46,100	47,907	56,407	60,754	62,287	64,189	66,855	72,107	75,208	80,033	82,301
Plums	17,250	17,300	19,715	22,434	23,800	25,398	28,268	30,081	31,554	32,961	34,192
Prunes	104,000	105,000	106,269	111,383	119,429	128,704	138,753	155,978	165,161	171,945	176,647
Cherries	8,750	8,884	8,758	9,317	9,646	9,981	10,433	10,828	11,521	12,569	13,260
Figs	10,500	11,023	11,472	12,774	16,979	21,328	23,440	29,537	37,446	42,128	47,393
Olives	19,165	19,528	23,266	24,474	25,583	26,688	27,597	28,303	28,420	28,863	28,820
Grapefruit	2,568	3,109	3,642	3,935	4,067	4,205	4,379	4,972	6,223	7,828	8,993
Lemons	36,060	40,937	42,266	42,528	43,021	43,215	44,270	43,816	43,179	43,173	43,345
Oranges	145,000	162,000	171,928	175,415	176,800	177,978	181,341	184,060	185,891	187,259	191,327
Almonds	30,100	35,044	41,184	51,496	56,922	60,692	68,021	73,644	84,670	89,384	91,713
Walnuts	50,900	58,963	61,781	65,530	66,951	68,572	69,629	71,779	75,307	83,252	87,564
Totals (all tree fruits)[1]	643,558	689,192	724,861	771,304	803,160	834,177	877,000	931,520	986,411	1,037,108	1,069,160
Wine grapes	97,000	100,000	105,000	110,000	114,772	124,265	140,323	159,301	169,593	176,187	180,891
Table grapes	55,000	57,000	60,000	65,000	77,389	95,558	122,611	140,229	143,022	138,857	132,886
Raisin grapes	170,000	189,000	197,000	232,000	242,210	296,875	334,658	347,231	346,223	338,439	326,150
Totals (grapes)	322,000	346,000	362,000	407,000	434,371	516,698	597,592	646,761	658,838	653,483	639,927
Grand totals (fruits and grapes)[1]	965,558	1,035,192	1,086,861	1,178,304	1,237,531	1,350,875	1,474,592	1,578,281	1,645,249	1,690,591	1,709,087

[1] Avocados, pomegranates, persimmons and dates not included. (See Table 21).

In Table 23 is given a forecast of the bearing acreage of the important tree fruits for 1930, 1931, 1932, and also a forecast of the bearing acreage of grapes for 1930 and 1931 in comparison with the estimated bearing acreage of tree fruits and grapes for 1929. This forecast of future bearing acreages is based upon an estimate of recent plantings that, under normal conditions, should come into bearing during the next three years. An allowance also has been made for the acreage that may be taken out as being no longer profitable.

Table 23—Forecast of Bearing Acreage of Tree Fruits, 1929, 1930, 1931, 1932, and Grapes, 1929, 1930, 1931

	Estimated, 1929	Forecast, 1930	Forecast, 1931	Forecast, 1932
Apples	57,440	57,900	58,100	58,000
Peaches (clingstone)	76,012	78,000	80,400	78,300
Peaches (freestone)	60,692	59,800	59,400	58,300
Pears	69,461	73,400	78,600	82,200
Apricots	82,301	83,700	84,400	85,500
Plums	34,192	35,300	35,700	35,900
Prunes	176,647	179,900	181,200	181,100
Cherries	13,260	14,300	15,400	16,300
Figs	47,393	48,800	50,000	50,900
Olives	28,820	28,800	28,800	28,800
Grapefruit	8,993	10,000	10,500	11,800
Lemons	43,345	43,100	42,800	42,500
Oranges	191,327	193,500	194,300	196,000
Almonds	91,713	91,700	91,700	91,700
Walnuts	87,564	93,700	101,300	107,500
Totals (all tree fruits)[1]	1,069,160	1,091,900	1,112,600	1,124,900
Wine grapes	180,891	184,700	187,000	.....
Table grapes	132,886	131,800	130,000	.....
Raisin grapes	326,150	319,600	311,700	.....
Totals, grapes	639,927	636,100	628,700	.....
Grand totals[1]	1,709,087	1,728,000	1,741,300	.....

[1] Avocados, pomegranates, persimmons and dates not included.

Table 24—Estimated Acreage of Apples, Pears, and Apricots by Counties, 1929

	Apples		Pears		Apricots	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
The State	57,440	5,944	69,461	24,620	82,301	10,802
DISTRICT No. 1—						
Del Norte			4			
Humboldt	890	39	207	142	50	
Mendocino	1,235	195	2,187	3,183	48	
DISTRICT No. 2—						
Shasta	270	40	153	47	30	27
Siskiyou	167	26	42	2		
Trinity			12			
DISTRICT No. 3—						
Lassen	60		4		14	
Modoc	360	5	12			
Plumas	32		2			
DISTRICT No. 4—						
Alameda	180	10	1,338	125	3,300	196
Contra Costa	617	43	3,787	1,242	3,011	1,159
Lake	275	35	5,359	2,880	50	35
Marin	70	10	202	70	70	5
Monterey	3,606	240	1,910	560	2,280	353
Napa	430	354	2,300	1,875	110	125
San Benito	191	21	1,418	620	5,158	300
San Luis Obispo	710	344	1,490	218	400	81
San Mateo	374	20	457	211	245	40
Santa Clara	1,126	250	6,292	1,497	17,848	1,450
Santa Cruz	14,355	907	1,002	756	1,500	80
Sonoma	13,801	1,207	2,457	851	25	
DISTRICT No. 5—						
Butte	575	43	703	81	130	20
Colusa	15	10	126	333	700	436
Glenn	71		504	62	1,244	257
Sacramento	60	20	8,024	2,080	500	170
Solano	130	18	3,789	687	3,700	489
Sutter	98	16	956	303	146	25
Tehama	355	22	322	56	600	396
Yolo	64	18	2,594	756	2,550	167
Yuba	30	10	752	497	99	18
DISTRICT No. 5A—						
Fresno	1,200	20	230	30	2,800	300
Kern	974		1,075	5	1,719	
Kings	38		10		3,303	347
Madera	142		6	2	1,700	10
Merced	28		53		1,365	283
San Joaquin	70	10	1,877	1,118	1,113	381
Stanislaus	80	4	324	62	5,788	486
Tulare	1,100	585	423	369	2,039	499
DISTRICT No. 6—						
Alpine			1			
Amador	120	6	74		9	
Calaveras	174	10	63		23	
El Dorado	470	114	3,172	1,054		
Inyo	470	125	410	45	2	
Mariposa	170	11	8			
Mono	51		19			
Nevada	300		1,417	18		
Placer	482	12	4,673	1,182	175	10
Sierra	18		1			
Tuolumne	1,500	225	255	35		
DISTRICT No. 8—						
Imperial			21		44	
Los Angeles	976	95	4,693	830	1,923	103
Orange	251	75	77	17	182	2
Riverside	1,714		984	373	5,955	1,060
San Bernardino	5,660	47	732	110	2,328	12
San Diego	755	601	184	142	675	149
Santa Barbara	250	26	74	15	350	31
Ventura	300	75	200	79	7,000	1,300

Table 25—Estimated Acreage of Clingstone, Freestone and all Peaches by Counties, 1929

	Clingstone peaches		Freestone peaches		All peaches	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
The State	76,012	10,565	60,692	6,744	136,704	17,309
DISTRICT NO. 1—						
Humboldt	50	.....	49	.....	99	.....
Mendocino	92	20	92	20	184	40
DISTRICT NO. 2—						
Shasta	50	.....	205	60	255	60
Siskiyou	4	.....	34	.....	38	.....
DISTRICT NO. 3—						
Lassen	25	.....	25	.....	50	.....
Modoc	6	.....	5	.....	11	.....
DISTRICT NO. 4—						
Alameda	125	.....	120	.....	245	.....
Contra Costa	138	9	1,077	372	1,215	381
Lake	59	4	61	5	120	9
Marin	10	.....	50	9	60	9
Monterey	10	.....	195	6	205	6
Napa	20	.....	140	45	160	45
San Benito	589	11	160	13	749	24
San Luis Obispo	50	.....	320	53	370	53
San Mateo	107	25	108	20	215	45
Santa Clara	1,185	75	1,699	235	2,884	310
Santa Cruz	19	3	190	41	209	44
Sonoma	181	.....	150	30	331	30
DISTRICT NO. 5—						
Butte	3,773	609	1,569	138	5,342	747
Colusa	405	44	391	24	796	68
Glenn	229	5	780	.....	1,009	5
Sacramento	3,235	163	600	94	3,835	257
Solano	22	.....	2,539	333	2,561	333
Sutter	17,741	3,586	439	131	18,180	3,717
Tehama	181	100	1,481	514	1,662	614
Yolo	734	52	1,869	77	2,603	129
Yuba	3,764	579	29	3	3,793	582
DISTRICT NO. 5A—						
Fresno	2,168	156	12,688	200	14,856	356
Kern	211	50	676	155	887	205
Kings	884	162	3,585	300	4,469	462
Madera	1,314	63	1,965	20	3,279	83
Merced	5,972	59	3,486	516	9,458	575
San Joaquin	3,876	983	2,430	268	6,306	1,251
Stanislaus	8,770	1,176	3,209	347	11,979	1,523
Tulare	5,488	1,774	3,278	1,212	8,766	2,986
DISTRICT NO. 6—						
Amador	42	.....	140	.....	182	.....
Calaveras	22	.....	52	.....	74	.....
El Dorado	175	78	391	45	566	123
Inyo	40	2	41	2	81	4
Mariposa	12	.....	12	.....	24	.....
Mono	1	.....	1	.....	2	.....
Nevada	70	.....	80	.....	150	.....
Placer	2,188	69	6,217	280	8,405	349
Tuolumne	75	1	75	1	150	2
DISTRICT NO. 8—						
Los Angeles	2,100	156	2,211	225	4,311	381
Orange	15	5	44	11	59	16
Riverside	3,716	259	1,030	150	4,746	409
San Bernardino	5,931	251	3,101	616	9,032	867
San Diego	80	18	1,285	128	1,365	146
Santa Barbara	.....	.....	260	25	260	25
Ventura	58	18	58	20	116	38

Table 26—Estimated Acreage of Plums, Prunes and Cherries by Counties, 1929

	Plums		Prunes		Cherries	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
The State	34,192	3,629	176,647	14,217	13,260	5,647
DISTRICT NO. 1—						
Humboldt	135		125	3	60	2
Mendocino	12		1,350	120	95	5
DISTRICT NO. 2—						
Shasta	60		1,100	175	30	18
Siskiyou	10		40		29	
Trinity	7		7			
DISTRICT NO. 3—						
Lassen	2		2		3	
Modoc	13				27	
DISTRICT NO. 4—						
Alameda	100	40	1,700	100	600	120
Contra Costa	137	7	2,160	96	275	130
Lake	2	2	1,200	404	15	10
Marin	28		127		15	8
Monterey	45		554		18	7
Napa	48	32	11,000	1,500	320	293
San Benito	50	8	7,177	441	40	8
San Luis Obispo	176	50	2,250	46	60	15
San Mateo	120	12	140	7	70	16
Santa Clara	1,450	110	66,763	1,538	3,370	1,277
Santa Cruz		56	1,125	22	375	50
Sonoma	510	78	24,112	3,067	1,427	195
DISTRICT NO. 5—						
Butte	280	5	7,850	183	95	6
Colusa	26		4,300	1,135		
Glenn	23		3,778	200	7	
Sacramento	3,200	461	2,900	648	450	268
Solano	4,869	220	5,388	192	1,050	317
Sutter	398	228	6,973	1,711	345	224
Tehama	50	17	3,435	245	90	113
Yolo	1,480	58	3,042	255	112	25
Yuba	35	20	1,090	1,008	12	101
DISTRICT NO. 5A—						
Fresno	3,300	200	1,724	103	105	10
Kern	1,120	46	302		21	
Kings	150	30	740			40
Madera	575		90			
Merced	149	49	118	1	17	1
San Joaquin	1,833	100	1,875	137	1,798	952
Stanislaus	171	4	654	95	150	54
Tulare	3,715	420	9,739	552	235	239
DISTRICT NO. 6—						
Amador	225		165		13	
Calaveras	17		76		6	
El Dorado	450	125	5		145	122
Inyo	20		26		12	
Mariposa	27		10			
Nevada	268		4		60	
Placer	7,823	853	32		600	224
Tuolumne			13		1	1
DISTRICT NO. 8—						
Imperial	18					
Los Angeles	453	104	18	73	16	31
Orange	13	1				
Riverside	25		765	50	452	578
San Bernardino	193	165	65		431	148
San Diego	350	121	318	102	132	28
Santa Barbara	15		10	5	45	11
Ventura	16	7	210	3	31	

Table 27—Estimated Acreage of Citrus Fruits by Counties, 1929

	Grapefruit		Lemons		Oranges	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
The State	8,993	5,183	43,345	2,954	191,327	24,490
NORTHERN CALIFORNIA—						
Butte					1,540	142
Colusa	25		720		53	
Glenn	21		93		730	425
Placer					235	
Sacramento	40		30		1,475	67
Solano					14	
Tehama					22	20
Yolo					17	4
Yuba					43	
CENTRAL CALIFORNIA—						
Fresno	10		260		4,550	150
Kern	24	17	8		1,374	34
San Joaquin					130	1
Stanislaus			8		136	1
Tulare	1,181	23	2,688	12	36,307	582
Tuolumne					2	
SOUTHERN CALIFORNIA—						
Imperial	4,680	3,630			106	
Los Angeles	499	104	11,699	158	41,591	3,163
Orange	95	60	6,634	1,166	41,279	10,757
Riverside	716	936	3,713	1	15,945	534
San Bernardino	1,538	329	5,434	20	39,577	1,906
San Diego	143	74	4,460	530	1,748	2,232
Santa Barbara	8		1,686	262	168	116
Ventura	13	10	5,912	805	4,285	4,356

Table 28—Estimated Acreage of Oranges by Varieties, 1929

	Navels		Valencias		Miscellaneous	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
The State	97,118	3,414	91,358	20,892	2,851	184
NORTHERN CALIFORNIA—						
Butte	1,540	142				
Colusa	48		5			
Glenn	709	425	21			
Placer	235					
Sacramento	1,425	67	50			
Solano	14					
Tehama	22	20				
Yolo	17	4				
Yuba	43					
CENTRAL CALIFORNIA—						
Fresno	4,250	150	300			
Kern	1,307	24	67	10		
San Joaquin	130	1				
Stanislaus	136	1				
Tulare	26,265	397	9,573	88	469	97
Tuolumne	2					
SOUTHERN CALIFORNIA—						
Imperial	106					
Los Angeles	16,538	409	24,345	2,746	708	8
Orange	982	9	40,204	10,746	93	2
Riverside	12,084	321	3,364	148	497	65
San Bernardino	20,225	1,094	9,437	812	915	
San Diego	768	235	935	1,985	45	12
Santa Barbara	148	15	20	101		
Ventura	1,124	100	3,037	4,256	124	

Table 29—Estimated Acreage of Avocados, Persimmons and Pomegranates by Counties, 1929

	Avocados		Persimmons		Pomegranates	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
The State	1,820	3,121	1,208	1,929	1,588	23
DISTRICT NO. 2—						
Shasta			20	65		
DISTRICT NO. 4—						
Marin			1			
San Mateo			6	1	1	
DISTRICT NO. 5—						
Butte		5			7	
Glenn	1		7	7		
Sacramento		1	50	3		
Sutter			28	80	25	1
Tehama			30			
Yolo			3			
Yuba			16			
DISTRICT NO. 5A—						
Fresno	10				10	
Kern			10	30	69	4
Kings			12			
Madera					8	
Merced			5		14	
San Joaquin				12		
Stanislaus			44	42	30	5
Tulare	8	4	95	154	1,315	5
DISTRICT NO. 6—						
Placer			80	45		
DISTRICT NO. 8—						
Imperial					61	
Los Angeles	753	581	324	336		
Orange	310	214	200	536		
Riverside	12	16	52	281	10	
San Bernardino	15	25	18	62		
San Diego	675	2,170	172	260	37	8
Santa Barbara	36	105	35	15		
Ventura					1	

Table 30—Estimated Acreage of Kadota, All Other, and All Figs by Counties, 1929

	Kadota figs		All other figs		All figs	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
The State	7,118	7,648	40,275	3,555	47,393	11,203
DISTRICT NO. 1—						
Mendocino			10	8	10	8
DISTRICT NO. 2—						
Shasta			30	10	30	10
DISTRICT NO. 4—						
Alameda			17		17	
Contra Costa	140		25	4	165	4
Lake			15	17	15	17
Marin			1		1	
San Luis Obispo			44	25	44	25
San Mateo			30	13	30	13
Santa Clara			40	83	40	83
Santa Cruz				6		6
Sonoma			30		30	
DISTRICT NO. 5—						
Butte			300	63	300	63
Colusa			22	95	22	95
Glenn	307	155	316		623	155
Sacramento	55		145	15	200	15
Solano	25		239	40	264	40
Sutter			161		161	
Tehama			167	197	167	197
Yolo			700	355	700	355
Yuba	29	5	121	25	150	30
DISTRICT NO. 5A—						
Fresno	1,496	5	18,200	700	19,696	705
Kern	97		166		263	
Kings	15		10		25	
Madera	50		2,566	173	2,616	173
Merced	1,930	807	7,320	459	9,250	1,266
San Joaquin	1,250	500	2,085	40	3,335	540
Stanislaus	793		2,007	336	2,800	336
Tulare	500	175	4,678	647	5,178	822
DISTRICT NO. 6—						
Calaveras			13		13	
El Dorado			9		9	
Mariposa			30		30	
Nevada			12		12	
Placer			67	2	67	2
Tuolumne	5		20	1	25	1
DISTRICT NO. 8—						
Imperial			47		47	
Los Angeles	406	367	129	48	535	415
Orange			3	12	3	12
Riverside		5,604	77	39	77	5,643
San Bernardino			63	46	63	46
San Diego	20	30	324	83	344	113
Santa Barbara			8	6	8	6
Ventura			28	7	28	7

Table 31—Estimated Acreage of Olives, Almonds and Walnuts by Counties, 1929

	Olives		Almonds		Walnuts	
	Bearing	Non-bearing	Bearing	Non-bearing	Bearing	Non-bearing
The State	28,820	3,412	91,713	5,398	87,564	39,921
DISTRICT No. 1—						
Humboldt					75	
Mendocino			11	1	100	30
DISTRICT No. 2—						
Shasta	75	1,250	25		20	65
Siskiyou			6			
DISTRICT No. 4—						
Alameda			200	6	100	20
Contra Costa	50	3	3,000	154	3,686	1,528
Lake	28	5	518	172	1,000	2,600
Marin	5		15	1	14	
Monterey			4,000		153	7
Napa			43		150	505
San Benito			147		227	143
San Luis Obispo	10		29,200	1,979	425	148
San Mateo	130	1	28	10	170	19
Santa Clara	50		425		2,505	1,346
Santa Cruz						18
Sonoma	185		40		700	555
DISTRICT No. 5—						
Butte	4,248	337	7,990	227	356	52
Colusa	12	6	6,421	221	142	600
Glenn	606		3,134	425	164	443
Sacramento	2,355		2,100	112	280	40
Solano	45		1,530	190	195	15
Sutter	90		2,279	85	762	877
Tehama	1,450	636	940	375	237	278
Yolo	550	121	11,350	232	155	133
Yuba	890	142	149	13	31	345
DISTRICT No. 5A—						
Fresno	1,286	75	150	10	310	20
Kern	953		50		101	
Kings	250	10	20		45	30
Madera	440		295			
Merced	200	8	2,339	353	460	326
San Joaquin	600	4	5 864	258	5,184	649
Stanislaus	400		5,113	106	765	231
Tulare	7,538	780	1,010	248	1,796	957
DISTRICT No. 6—						
Amador			20			
Calaveras	123		50		45	
El Dorado	5				37	33
Nevada					112	
Placer	360	20	414			
Tuolumne			1		125	65
DISTRICT No. 8—						
Imperial	59					
Los Angeles	1,365	1	603	73	27,056	6,454
Orange	30			25	12,232	285
Riverside	1,205	5	1,275		2,653	3,789
San Bernardino	1,165		15		3,507	7,443
San Diego	1,300	8	140	46	360	987
Santa Barbara	350		3		5,600	520
Ventura	412		800	76	15,329	8,365

Table 32—Estimated Acreage of Grapes by Classes and by Counties, 1929

	Bearing			Nonbearing			Total bearing and nonbearing
	Wine	Table	Raisin	Wine	Table	Raisin	
The State	180,891	132,886	326,150	10,078	2,525	528	653,058
DISTRICT NO. 1—							
Humboldt	70						70
Mendocino	9,200			690			9,890
DISTRICT NO. 2—							
Shasta	210	90	65	75	27		467
Siskiyou	15	21					36
Trinity	5						5
DISTRICT NO. 3—							
Lassen	10						10
DISTRICT NO. 4—							
Alameda	3,700			100			3,800
Contra Costa	3,506	350	4	244	10		4,114
Lake	395			78			473
Marin	445			5			450
Monterey	234	80		8			322
Napa	10,890			400			11,290
San Benito	1,225			10			1,235
San Luis Obispo	910			60			970
San Mateo	173			7			180
Santa Clara	10,100			107			10,207
Santa Cruz	1,550	170		20			1,740
Sonoma	20,500			750			21,250
DISTRICT NO. 5—							
Butte	600	147		20	45		812
Colusa	316	76	2,082	95	11	54	2,634
Glenn	155	409	475				1,039
Sacramento	4,500	11,900	9	90	120		16,619
Solano	1,797	239		220			2,256
Sutter	1,979	163	8,305	306	232	48	11,033
Tehama	500	99	230	83	10		922
Yolo	1,992	1,175	1,775	137	12	30	5,121
Yuba	1,052	20	1,682	333		4	3,091
DISTRICT NO. 5A—							
Fresno	15,683	30,591	170,768	350	100		217,492
Kern	2,702	7,066	10,217	266	199	36	20,486
Kings	412	167	16,594	70			17,243
Madera	4,420	3,181	19,822	355			27,778
Merced	6,044	6,134	8,062	253	101	50	20,644
San Joaquin	24,986	33,006	725	770	55		59,542
Stanislaus	9,434	5,756	10,254	893	12	11	26,360
Tulare	2,484	19,128	59,793	438	476	173	82,492
DISTRICT NO. 6—							
Amador	20						20
Calaveras	324	102	19				445
El Dorado	540	54		16			610
Inyo	130	105					235
Mariposa	35						35
Nevada	150	40					190
Placer	3,750	1,660		89	3		5,502
Tuolumne	170	15	20	24	3	6	238
DISTRICT NO. 8—							
Imperial		2,351	1,487				3,838
Los Angeles	6,383	300		200	23		6,906
Orange	370						370
Riverside	2,300	2,501	1,018	1,940	565		8,324
San Bernardino	22,315	2,721	9,401	396	83	50	34,966
San Diego	2,022	2,064	3,343	166	399	66	8,060
Santa Barbara	188	155		14	2		359
Ventura		850			37		887

Table 33—Estimated Acreage Planted to Grapes by Classes and by Counties, 1927 and 1928

	Planted, 1927			Planted, 1928		
	Wine	Table	Raisin	Wine	Table	Raisin
The State	5,285	1,574	455	4,793	951	73
District No. 1—						
Mendocino	500			190		
District No. 2—						
Shasta	40	7		35	20	
District No. 4—						
Alameda	50			50		
Contra Costa	119	10		125		
Lake	60			18		
Marin	5					
Monterey	2			6		
Napa	200			200		
San Benito				10		
San Luis Obispo	50			10		
San Mateo	7					
Santa Clara	107					
Santa Cruz	20					
Sonoma	250			500		
District No. 5—						
Butte		25		20	20	
Colusa	70	5	54	25	6	
Sacramento	50	100		40	20	
Solano	100			120		
Sutter	221	215	43	85	17	5
Tehama	68	10		15		
Yolo	112	12	30	25		
Yuba	83		4	250		
District No. 5A—						
Fresno	350	100				
Kern	244	133	36	22	66	
Kings	50			20		
Madera	105			250		
Merced	103	51	50	150	50	
San Joaquin	150	40		620	15	
Stanislaus	193	10	11	700	2	
Tulare	328	348	110	110	128	63
District No. 6—						
El Dorado	6			10		
Placer	89	3				
Tuolumne	4	1	1	20	2	
District No. 8—						
Los Angeles	150	10		50	13	
Riverside	1,100	383		840	182	
San Bernardino	246	50	50	150	33	
San Diego	41	24	66	125	375	
Santa Barbara	12			2	2	
Ventura		37				

Table 34—Estimated Acreage of Peaches by Age and Variety for California, 1929

Varieties	Total acreage by varieties	Number of acres of peach trees of each age					
		1 and 2 years old	3 and 4 years old	5 and 6 years old	7 and 8 years old	9 and 10 years old	11 years old and over
Clingstones—							
Tuscan	22,089	575	711	3,189	5,133	3,020	9,461
Paloro	10,419	1,887	2,570	4,140	1,591	114	117
Hauss	2,550	44	209	551	521	537	688
Peak	5,088	521	802	1,453	1,741	324	247
Orange	1,671	24	44	139	356	84	1,024
Johnson	1,173	50	214	455	145	33	276
Walton	410	43	40	118	100	38	71
Gaume	3,669	1,254	1,130	1,027	95	158	5
Albright	213	2		1	14	13	183
McDevitt	122		12	15	40		55
Sims	4,843	375	310	1,021	2,003	526	608
Libbee	925	1	49	364	365	91	55
Selma	166		2	25	137	2	
Phillips	30,824	1,857	3,091	7,458	6,681	2,819	8,918
Levi	1,529		1	53	150	164	1,161
All others	886	215	141	164	79	54	233
Total clingstones	86,577	6,848	9,326	20,173	19,151	7,977	23,102
Freestones—							
Muir	19,437	699	539	833	1,328	915	15,123
Elberta	18,104	1,259	1,213	2,345	2,162	679	10,446
Lovell	16,326	692	830	1,575	2,029	1,169	10,031
(Early and late)							
Crawfords	2,856	41	72	88	147	47	2,461
J. H. Hale	3,298	1,305	765	549	348	135	196
Salway	1,264	5	141	120	61	122	815
Alexander	718	76	46	26	46	34	490
Hales Early	665	36	32	24	44	18	511
Other yellow frees	4,451	515	239	332	247	218	2,900
Other white frees	317	47	27	25	10	33	175
Total freestones	67,436	4,675	3,904	5,917	6,422	3,370	43,148
Total state	154,013	11,523	13,230	26,090	25,573	11,347	66,250

Table 36—Estimated Acreage of Peaches by Age and Variety—Northern California, 1929

Varieties	Total acreage by varieties	Number of acres of peach trees of each age					
		1 and 2 years old	3 and 4 years old	5 and 6 years old	7 and 8 years old	9 and 10 years old	11 years old and over
Clingstones—							
Tuscan	7,330	185	266	1,611	1,395	540	3,333
Paloro	4,329	668	1,025	1,986	576	29	45
Hauss	1,995	16	126	412	483	340	618
Peak	2,385	356	522	903	483	78	43
Orange	209	----	5	11	34	14	145
Johnson	1,168	49	214	454	142	33	276
Walton	405	43	40	113	100	38	71
Gaume	2,882	861	993	770	95	158	5
Albright	213	2	----	1	14	13	183
McDevitt	79	----	12	15	3	----	49
Sims	1,216	135	152	587	223	71	48
Libbee	421	----	31	196	162	32	----
Selma	30	----	----	8	22	----	----
Phillips	14,220	760	1,570	4,485	3,238	1,065	3,102
Levi	1,168	----	1	32	87	148	900
All others	315	71	52	55	54	24	59
Total clingstones	38,365	3,146	5,009	11,639	7,111	2,583	8,877
Freestones—							
Muir	4,654	112	272	369	388	173	3,340
Elberta	5,850	514	461	601	486	287	3,501
Lovell	2,385	173	235	293	113	86	1,485
(Early and late)							
Crawfords	1,585	16	39	86	61	32	1,351
J. H. Hale	521	144	198	81	33	2	63
Salway	449	5	10	72	16	8	338
Alexander	159	8	21	26	21	11	72
Hales Early	512	1	13	24	21	13	440
Other yellow frees	2,838	161	102	176	110	104	2,185
Other white frees	191	27	17	14	5	1	127
Total freestones	19,144	1,161	1,368	1,742	1,254	717	12,902
Total all peaches	57,509	4,307	6,377	13,381	8,365	3,300	21,779

NOTE.—Northern California includes the counties of Amador, Butte, Colusa, Del Norte, El Dorado, Glenn, Humboldt, Lake, Lassen, Marin, Mendocino, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, Shasta, Sierra, Siskiyou, Solano, Sonoma, Sutter, Tehama, Trinity, Yolo and Yuba.

Table 36—Estimated Acreage of Peaches by Age and Variety—Central California, 1929

Varieties	Total acreage by varieties	Number of acres of peach trees of each age					
		1 and 2 years old	3 and 4 years old	5 and 6 years old	7 and 8 years old	9 and 10 years old	11 years old and over
Clingstones—							
Tuscan	9,654	355	277	1,397	2,522	1,567	3,536
Paloro	5,647	1,077	1,481	1,955	977	85	72
Hauss	524	28	56	135	38	197	70
Peak	2,457	139	260	497	1,219	138	204
Orange	1,276	21	28	124	320	68	715
Johnson	5	1		1	3		
Walton	5			5			
Gaume	787	393	137	257			
Albright							
McDevitt	43				37		6
Sims	1,145	172	78	147	601	57	90
Libbee	504	1	18	168	203	59	55
Selma	50		2	6	40	2	
Phillips	12,663	852	1,405	2,733	2,693	1,260	3,720
Levi	320			20	63	16	221
All others	525	135	89	109	25	30	137
Total clingstones	35,605	3,174	3,831	7,554	8,741	3,479	8,826
Freestones—							
Muir	13,742	587	266	464	927	728	10,770
Elberta	11,187	707	709	1,728	1,515	314	6,214
Lovell (Early and late)	9,788	516	470	999	1,267	441	6,095
Crawfords	1,108	23	7	2	86	15	975
J. H. Hale	1,242	647	163	222	91	64	55
Salway	390		122	25	7	11	225
Alexander	524	68	17		21		418
Hales Early	144	35	13		23	5	68
Other yellow frees	950	185	94	116	107	20	428
Other white frees	53		10	11	5		27
Total freestones	39,128	2,768	1,871	3,567	4,049	1,598	25,275
Total all peaches	74,733	5,942	5,702	11,121	12,790	5,077	34,101

NOTE.—Central California includes the counties of Alameda, Alpine, Calaveras, Contra Costa, Fresno, Inyo, Kern, Kings, Madera, Mariposa, Merced, Mono, Monterey, San Benito, San Joaquin, San Luis Obispo, San Mateo, Santa Clara, Santa Cruz, Stanislaus and Tuolumne.

Table 37—Estimated Acreage of Peaches by Age and Variety—*Southern California, 1929

Varieties	Total acreage by varieties	Number of acres of peach trees of each age					
		1 and 2 years old	3 and 4 years old	5 and 6 years old	7 and 8 years old	9 and 10 years old	11 years old and over
Clingstones—							
Tuscan	5,105	35	168	181	1,216	913	2,592
Paloro	443	142	64	199	38		
Hauss	31		27	4			
Peak	246	26	20	53	39	108	
Orange	186	3	11	4	2	2	164
Johnson							
Walton							
Gaume							
Albright							
McDevitt							
Sims	2,482	68	80	287	1,179	398	470
Libbee							
Selma	86			11	75		
Phillips	3,941	245	116	240	750	494	2,096
Levi	41			1			40
All others	46	9					37
Total clingstones	12,607	528	486	980	3,299	1,915	5,399
Freestones—							
Muir	1,041		1		13	14	1,013
Elberta	1,067	38	43	16	161	78	731
Lovell	4,153	3	125	283	649	642	2,451
(Early and late)							
Crawfords	163	2	26				135
J. H. Hale	1,535	514	404	246	224	69	78
Salway	425		9	23	38	103	252
Alexander	35		8		4	23	
Hales Early	9		6				3
Other yellow frees	663	169	43	40	30	94	287
Other white frees	73	20				32	21
Total freestones	9,164	746	665	608	1,119	1,055	4,971
Total all peaches	21,771	1,274	1,151	1,588	4,418	2,970	10,370

NOTE.—Southern California includes the counties of Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, Santa Barbara and Ventura.

* Southern California figures include the acreage that is not being properly cared for, or is partially abandoned.

Table 38—Estimated Acreage of Pears by Age and Variety, 1929

Variety	1928 plantings	2 years old	3 years old	4 years old	5 years old	6 years old	7 years old	8 years old	9 years old	10 years old
Bartlett	1,691	2,030	4,135	4,975	4,858	5,241	5,497	5,092	4,798	3,273
Beurre Anjou		23	30	66	33	107	44	68	56	30
Beurre Hardy		146	387	398	363	463	334	78	129	29
Beurre Bosc		204	227	448	272	200	152	116	143	43
Beurre Clairgeau		5	17	5	43	109	114	48	69	13
Comice		43	50	10	19	77	48	36	53	15
Easter Beurre		78	134	243	125	167	52	13	41	6
Winter Nelis		157	191	281	299	302	330	183	150	91
All others		59	115	107	123	100	118	49	68	20
Totals, fall and winter varieties	635	715	1,151	1,558	1,277	1,525	1,192	591	709	247
Grand totals	2,326	2,745	5,286	6,533	6,135	6,766	6,689	5,683	5,507	3,520

Table 38—Estimated Acreage of Pears by Age and Variety, 1929—Continued

Variety	11 years old	12 years old	13 years old	14 years old	15 to 19 years old	20 to 24 years old	25 to 29 years old	30 years and over	Totals by varieties
Bartlett	3,282	4,032	4,698	4,634	10,092	2,897	1,949	8,275	81,449
Beurre Anjou	58	51	85	80	154		1	20	906
Beurre Hardy	47	45	81	4	23	11	1	43	2,582
Beurre Bosc	30	18	77	24	41			4	1,999
Beurre Clairegeau	23	18	26	68	75	11		85	729
Comice	47	13	118	37	175	2	5	7	755
Easter Beurre			4	1	37	7		41	949
Winter Nelis	51	121	116	62	260	50	39	154	2,837
All others	33	20	86	55	88	54	14	131	1,240
Totals, fall and winter varieties	289	286	593	331	853	135	60	485	12,632
Grand totals	3,571	4,318	5,291	4,965	10,945	3,032	2,009	8,760	94,081

A BRIEF REVIEW OF CALIFORNIA LIVESTOCK SITUATION 1928

Pastures and Ranges—Grazing conditions in the state during 1928 were about average, but there was considerable variation between different sections. In general, precipitation was deficient in the southern half of the state, where in numerous areas natural feeds were below requirements of stock, especially in the latter part of the year. It was also too dry for best range feeds in some of the high mountain districts. Pasture feeds were excellent in northern valley areas, particularly during the spring and early summer.

Cattle and Calves—There was a two per cent decrease recorded in total numbers of all cattle and calves in California during 1928. Milk cow numbers showed a two per cent increase, so that beef animals actually decreased around three per cent. Decreases in beef cattle resulted from slaughter that was near normal, accompanied by inshipments that were lighter than average. The average value of all cattle, especially beef stock, appreciated materially in 1928, so that now the average values of all cattle and milk cows in California are at the highest level on record.

It was a good year for the beef cattle industry, both as to physical conditions and as to demand and prices. In some localities where rainfall was deficient, cattle failed to make normal gains or had to be shifted to other areas. Considerable supplementary feeding was done during the latter part of the season. Marketings of cattle off grass were again heavy, and most of the cattle attained good finish. The total slaughter of cattle and calves in 1928 was a little less than for either 1927 or 1926, apparently due to a cessation of liquidation and to smaller imports for immediate slaughter—both reflections of high prices. Inspected calf slaughter around Los Angeles and the Bay District registered a slight increase over 1927, but apparently the total calf slaughter in the state was less than for the previous year. Data indicates that more calves were raised in 1928 than in either 1926 or 1927.

The "imports" of cattle and calves from other states in 1928 were about 22 per cent less than the high record of 1927, most of this decline coming in stocker and feeder cattle. Total "imports" were smaller than the average for the previous six years. The sharp falling off in inshipments was due mainly to unsatisfactory fall pasture conditions in some important cattle counties, and to high prices asked for relatively fewer cattle in nearby states. Present supplies of cattle are not burdensome to California markets, and in view of the limited numbers of cattle in western areas, it appears that market supplies will not become excessive until a rather slow restocking process materially increases basic numbers.

In Table 40 is shown the estimated number of all cattle and calves by counties as of January 1, 1928 and 1929.

In Table 43 is given the estimated number, value per head, and total value of all cattle and calves on farms and ranges in California and the Unites States on January 1, 1920 to 1929, inclusive.

Milk cows continue to increase in the state. Available records indicate higher average production per cow each year. Prices for milk and butter fat were good throughout the year. The cost of producing milk probably increased somewhat in 1928 because of local scarcities of natural feeds due to deficient rainfall, which necessitated the purchase

of more hay and other feeds than usual. Further gradual growth in the dairy industry is anticipated. Beef cattle numbers will likely continue around the present level, unless unusual conditions arise to disturb present tendencies.

In Table 40 is shown the estimated number of milk cows, 2 years old and over, by counties as of January 1, 1928 and 1929.

In Table 43 is given the estimated number, value per head, and total value of milk cows, 2 years old and over, on farms and ranges in California and the United States on January 1, 1920 to 1929, inclusive.

In Table 39 is given the number of heifers, 1 to 2 years old, being kept for milk cows, for California and the United States, from 1920 to 1929, inclusive:

Table 39—Estimated Number of Heifers, 1 to 2 years old, Being Kept for Milk Cows, 1920-1929

Year	California	United States
1920	114,000	4,418,000
1921	102,000	4,155,000
1922	100,000	4,023,000
1923	123,000	4,147,000
1924	151,000	4,137,000
1925	132,000	4,195,000
1926	137,000	3,923,000
1927	142,000	4,059,000
1928	149,000	4,201,000
1929	152,000	4,377,000

Sheep and Lambs—California sheep numbers increased about nine per cent during 1928, so that now there are 33 per cent more sheep here than in 1920, and about 55 per cent more than in 1922. Expansion in the sheep industry has been noted in all districts of the state, but it recently has been greater in the northern half of the state, in and adjacent to the Sacramento Valley and in coastal counties. In the process of increasing sheep numbers, considerable land formerly devoted to cattle production has been turned over to sheep. Values of sheep still are at high levels, and the demand for stock sheep remains strong at such prices.

On the whole, 1928 was a favorable year for the California sheep industry. The lamb crop was good, feed conditions about average for finishing lambs, and sales of lambs and wool returned a margin of profit to most growers. Poor natural feeds in some areas made it necessary for operators to purchase more supplementary feed, and to move flocks frequently to new feed, thus generally increasing production costs. Out-of-state shipments of early spring lambs (live and dressed) in 1928 exceeded 450,000 eclipsing the previous record established in 1927. On the other hand the inshipments of sheep and lambs, which include both breeding and slaughter animals, amounted to about 600,000 head, a record number for the period beginning 1922, for which data are available. The inspected slaughter of lambs and sheep for 1928 was slightly larger than in 1927, and about the same as in 1926. Progress is being made by the sheep growers in the way of better breeding, feeding, care and management, and by efforts to reduce losses caused by predatory animals, dogs, parasites and various other causes.

In Table 40 is shown the estimated number of sheep and lambs by counties as of January 1, 1928 and 1929.

In Table 43 is given the estimated number, value per head, and total value of sheep and lambs on farms and ranges in California and the United States on January 1, 1920 to 1929, inclusive.

Hogs—About the same number of hogs were in the state at the beginning and end of the year 1928, and inventorial numbers were highest since 1923. The December 1928 Pig Survey indicated that the spring pig crop of 1929 would be smaller than the spring crop of 1928, but advancing prices for hogs will have a tendency to again stimulate hog production.

California marketed more hogs in 1928 than in any of the previous 5 years. Inspected hog slaughter in the state in 1928 exceeded that of any of the past seven years. This resulted from abundant supplies of hogs at prices that were low compared with cattle and lamb prices, and in the usual procedure of building up heavy storage holdings of pork at such periods. Relatively low hog prices caused some growers to abandon this phase of husbandry, but the later much-improved market outlook for hogs helped to avoid general liquidation of herds. About 800,000 head of live hogs were shipped into California in 1928, practically all of which were for immediate slaughter. This compares with about 650,000, the average number "imported" in the previous six years. California farmers produced approximately half of the total hogs slaughtered in the state in 1928. While there are no records of the considerable quantities of pork and pork products shipped into California each year, it is quite evident that California growers are producing fully 40 per cent of the pork and pork products consumed in the state.

In Table 41 is shown the estimated number of hogs by counties as of January 1, 1928 and 1929.

In Table 43 is given the estimated number, value per head, and total value of swine, including pigs, on farms and ranges in California and the United States on January 1, 1920 to 1929, inclusive.

Horses and Mules—Numbers of horses and mules continue to decrease in the state, the decline being much more rapid for horses. Since 1920 the total decrease in horses has been about 34 per cent and in mules, 19 per cent. Prices apparently reached the low point in 1928 and showed a slight recovery by January, 1929. There is little incentive for raising horses, and numbers may be expected to show some further decline.

In Table 41 is shown the estimated number of horses and mules by counties as of January 1, 1928 and 1929.

In Table 43 is given the estimated number, value per head, and total value of horses and mules on farms and ranges in California and the United States on January 1, 1920 to 1929, inclusive.

ESTIMATED VALUE OF PRODUCTION OF CALIFORNIA LIVESTOCK—1926-1927-1928

The annual estimates of the value of production of cattle, hogs, and sheep, as made by the Division of Crop and Livestock Estimates, represent the gross farm value of livestock sold off and slaughtered on farms and ranges during the year, less the values of stocker and feeder animals brought on farms from outside sources. These estimates are based upon all available data relating to slaughter, deaths, outshipments, inshipments, young animals raised, changes in inventory numbers, monthly prices, etc. These estimates for California covering the years 1926, 1927 and 1928 are given below.

Comparable estimates for the values of dairy and poultry products are not yet being compiled by this Division, owing to insufficient funds to collect current basic data. But to show something of the relative importance of these industries in the state, there are included the estimated values of all butterfat sold in 1927 and 1928, as compiled by the Bureau of Dairy Control, State Department of Agriculture. These figures, while not on exactly the same basis as those for meat animals, are considered as sufficiently accurate in showing the total gross farm income from sales of all butterfat. The combined value of chickens raised and eggs produced in 1924 as shown by the Agricultural Census of 1925, is given simply to furnish a partial basis for comparing the various phases of livestock production in the state.

Estimated Value of Livestock Production in California

(In thousands of dollars; i.e. 000 omitted)

	1926	1927	1928
Cattle and calves	[illegible]	[illegible]	$39,690
Sheep, lambs and wool	[illegible]	[illegible]	25,189
Hogs	[illegible]	[illegible]	[illegible]
Value of all butterfat sold from farms	[illegible]	$84,936	[illegible]
Value of chickens raised and eggs produced in 1924 ..	$44,424	..	..

[illegible] Data furnished by State Bureau of Dairy Control.
[illegible] Census of 1925 ..

Table 40 Estimated Numbers of Livestock by Counties, January 1, 1928 and 1929

Counties	All cattle and calves		Milk cows 2 years old and over		Sheep and lambs	
	1928	1929	1928	1929	1928	1929
DISTRICT No. 1—						
Del Norte	8,100	8,200	4,700	4,800	1,000	1,000
Humboldt	82,000	82,400	25,500	25,600	90,000	99,000
Mendocino	29,300	29,500	8,200	8,300	145,000	152,000
DISTRICT No. 2—						
Shasta	36,000	34,000	3,000	3,100	40,000	42,000
Siskiyou	53,000	51,000	8,600	8,700	40,000	43,000
Trinity	12,500	12,000	500	500	5,000	6,000
DISTRICT No. 3—						
Lassen	32,000	31,000	3,100	3,200	83,000	90,000
Modoc	62,000	60,000	4,200	4,300	97,000	108,000
Plumas	8,800	8,600	2,400	2,400	4,000	5,000
DISTRICT No. 4—						
Alameda	32,500	32,000	11,500	11,400	32,000	37,000
Contra Costa	26,500	26,500	7,200	7,200	45,000	50,000
Lake	7,300	7,300	2,100	2,100	22,000	27,000
Marin	36,500	36,500	25,500	25,300	9,000	10,000
Monterey	64,600	63,000	23,000	23,000	35,000	38,000
Napa	13,900	13,700	5,000	5,000	30,000	34,000
San Benito	29,000	28,000	3,300	3,300	40,000	45,000
San Luis Obispo	81,000	79,000	20,000	20,000	9,000	10,000
San Mateo	15,000	15,000	9,500	9,500	18,000	20,000
Santa Clara	41,000	41,000	15,000	15,000	1,000	3,000
Santa Cruz	7,600	7,700	3,300	3,300	2,000	3,000
Sonoma	44,000	44,000	26,000	26,200	90,000	104,000
DISTRICT No. 5—						
Butte	25,500	25,000	6,200	6,300	90,000	95,000
Colusa	18,000	17,000	4,000	4,100	200,000	220,000
Glenn	25,400	25,000	8,600	8,800	250,000	260,000
Sacramento	29,000	29,000	11,400	11,600	56,000	60,000
Solano	17,800	17,400	8,000	8,300	190,000	210,000
Sutter	10,500	10,400	4,600	4,700	60,000	67,000
Tehama	40,000	38,000	2,800	2,900	225,000	245,000
Yolo	24,000	24,000	10,700	11,000	190,000	200,000
Yuba	15,400	15,000	3,200	3,300	62,000	67,000
DISTRICT No. 5A—						
Fresno	100,000	97,000	27,000	27,400	210,000	225,000
Kern	132,000	130,000	10,500	10,600	210,000	225,000
Kings	44,000	42,000	23,000	23,300	132,000	145,000
Madera	30,000	29,000	8,000	8,300	55,000	60,000
Merced	72,000	70,000	39,000	39,500	115,000	125,000
San Joaquin	54,000	53,000	29,000	29,500	100,000	110,000
Stanislaus	78,000	75,000	41,000	41,500	60,000	65,000
Tulare	115,000	112,000	37,000	37,500	125,000	135,000
DISTRICT No. 6—						
Alpine	2,300	2,300	300	300	12,000	14,000
Amador	13,000	12,500	900	900	22,000	24,000
Calaveras	21,000	21,000	700	700	35,000	40,000
El Dorado	13,000	13,000	1,700	1,700	18,000	20,000
Inyo	11,000	10,000	1,100	1,100	22,000	25,000
Mariposa	12,000	11,500	300	300	20,000	22,000
Mono	9,000	8,500	400	400	26,000	28,000
Nevada	6,500	6,200	1,300	1,400	15,000	18,000
Placer	7,000	7,000	2,200	2,300	46,000	50,000
Sierra	6,000	5,800	1,300	1,300	1,000	2,000
Tuolumne	14,000	14,000	800	800	5,000	6,000
DISTRICT No. 8—						
Imperial	77,000	77,000	25,000	26,000	78,000	83,000
Los Angeles	58,000	58,000	45,000	46,000	7,000	10,000
Orange	19,000	19,000	9,000	9,500	2,000	3,000
Riverside	24,000	23,000	8,000	8,500	20,000	22,000
San Bernardino	40,000	39,000	12,400	12,800	4,000	5,000
San Diego	49,000	48,000	9,000	9,500	5,000	7,000
Santa Barbara	43,000	43,000	8,000	8,400	15,000	17,000
Ventura	17,000	17,000	3,000	3,300	7,000	8,000
Totals	1,995,000	1,955,000	614,000	626,000	3,528,000	3,846,000

Table 41—Estimated Numbers of Livestock by Counties, January 1, 1928 and 1929

Counties	Horses		Mules		Hogs	
	1928	1929	1928	1929	1928	1929
RICT No. 1—						
l Norte	500	400	20	20	600	600
mboldt	5,400	5,300	260	250	,000	6,000
ndocino	3,600	3,500	390	380	,000	14,000
RICT No. 2—						
sta	3,500	3,400	300	300	18,000	17,000
kiyou	5,700	5,500	420	410	12,000	10,000
nity	700	600	130	120	4,000	4,000
RICT No. 3—						
ssen	5,800	5,600	980	960	3,500	3,300
doc	7,600	7,400	850	810	5,000	4,500
mas	1,100	1,000	60	50	1,200	1,200
RICT No. 4—						
meda	5,400	5,200	100	100	15,000	14,000
ntra Costa	5,200	5,000	400	400	6,500	6,000
ke	1,400	1,300	240	230	6,000	5,000
rin	2,100	2,000	80	70	12,000	10,000
onterey	9,400	9,000	860	850	19,000	16,000
pa	2,600	2,500	280	280	18,000	17,000
n Benito	3,100	2,900	30	30	4,400	4,400
n Luis Obispo	8,600	8,300	600	600	17,000	16,000
n Mateo	2,300	2,200	50	50	3,200	3,200
nta Clara	7,800	7,600	400	380	5,000	5,000
nta Cruz	2,300	2,100	100	90	2,500	2,500
noma	8,600	8,400	390	380	16,000	15,000
RICT No. 5—						
tte	4,000	3,900	500	480	23,000	25,000
lusa	2,300	2,200	1,800	1,700	25,000	6,000
enn	3,200	3,100	1,500	1,450	19,000	1,000
eramento	7,400	7,100	500	450	9,000	9,300
lano	3,900	3,700	900	850	8,000	9,000
tter	2,900	2,800	900	850	12,000	2,000
hama	4,300	4,200	1,400	1,350	19,000	8,000
olo	5,200	5,000	1,400	1,400	40,000	6,000
uba	2,200	2,000	350	340	4,000	4,000
TRICT No. 5A—						
resno	17,000	16,300	5,000	5,000	18,000	),000
ern	8,400	8,000	2,200	2,150	16,000	7,000
ings	6,200	5,900	1,300	1,250	20,000	3,000
laders	3,800	3,600	2,100	2,000	12,000	2,000
lerced	7,700	7,300	1,900	1,900	16,000	),000
n Joaquin	12,700	12,100	1,300	1,300	20,000	4,000
anislaus	9,200	9,000	1,500	1,450	15,000	5,000
ulare	14,000	13,400	4,200	4,200	40,000	4,000
TRICT No. 6—						
lpine	150	150	10	10	200	200
mador	1,000	950	60	60	4,800	,000
alaveras	1,600	1,550	50	50	3,500	,000
l Dorado	1,600	1,500	100	100	2,000	,000
yo	1,900	1,800	400	400	500	500
lariposa	1,000	1,000	220	200	4,800	,000
lono	750	700	50	50	300	300
evada	800	800	50	50	1,800	,800
lacer	2,800	2,700	300	300	2,800	,800
ierra	500	450	20	20	400	400
uolumne	1,400	1,300	70	70	3,000	000
STRICT No. 8—						
mperial	9,200	9,000	3,800	3,700	33,000	,000
os Angeles	9,700	9,300	1,700	1,700	25,000	,000
range	4,000	3,700	2,200	2,150	3,000	000
iverside	8,000	7,600	2,100	2,100	8,000	000
an Bernardino	5,500	5,300	1,500	1,500	45,000	,000
an Diego	7,200	7,000	1,300	1,300	12,000	1000
anta Barbara	7,200	7,000	350	350	10,000	000
entura	6,600	6,400	2,100	2,050	4,000	000
Totals	278,000	267,000	52,070	51,040	670,000	67000

Table 4 -January 1 Farm Value of California Live Stock per Head, 1869-1929

Year	Horses, dollars	Mules, dollars	Milk cows, dollars	Other cattle, dollars	Sheep, dollars	Hogs, dollars
1869	$52.71	$73.92	$50.31	$27.86	$2.53	$5.52
1870	36.50	66.66	47.62	26.22	2.56	4.47
1871	50.26	65.64	46.36	26.92	2.59	5.94
1872	43.59	59.76	44.66	23.80	2.78	5.05
1873	44.15	71.06	43.44	22.71	2.97	6.11
1874	47.48	63.74	35.28	19.52	2.31	6.16
1875	41.61	66.49	32.19	18.92	2.53	5.77
1876	45.46	77.20	31.46	20.08	2.02	7.17
1877	39.50	67.75	30.64	16.52	1.40	6.20
1878	40.94	68.98	28.23	17.23	1.52	6.27
1879	43.95	66.24	25.90	18.91	1.61	5.95
1880	46.18	67.54	28.65	18.47	1.62	3.97
1881	45.03	68.79	31.67	20.35	1.70	4.98
1882	47.30	69.20	32.70	21.77	1.65	6.20
1883	54.89	70.98	36.17	27.48	2.02	7.14
1884	61.33	80.18	38.00	29.15	1.90	5.66
1885	62.05	84.30	38.50	30.38	1.89	5.80
1886	63.00	77.65	38.75	28.66	1.81	4.15
1887	64.00	83.67	33.22	20.64	1.77	3.78
1888	71.00	85.03	33.00	20.50	1.88	4.62
1889	70.19	83.78	31.38	19.37	1.88	5.59
1890	63.60	78.21	27.75	16.80	2.08	4.91
1891	67.22	79.41	29.00	17.73	2.20	5.26
1892	62.67	74.72	26.95	17.39	2.42	5.35
1893	57.48	67.90	27.25	17.12	2.32	6.12
1894	41.98	56.38	25.82	16.17	1.81	5.57
1895	31.94	46.25	23.78	15.28	1.65	5.54
1896	27.16	35.02	23.75	15.82	1.85	4.03
1897	27.40	36.89	25.57	16.93	1.86	4.13
1898	28.96	38.33	28.65	18.91	2.23	4.08
1899	27.54	34.15	28.00	18.01	2.64	4.47
1900	38.61	48.49	33.75	24.57	2.85	6.26
1901	49.66	60.44	37.10	22.25	3.00	6.61
1902	56.28	69.23	40.05	23.48	2.90	6.79
1903	60.66	72.02	40.43	24.51	2.92	7.63
1904	65.66	72.68	38.55	21.98	2.75	6.55
1905	67.48	76.39	36.57	19.29	2.67	6.10
1906	76.32	91.30	34.65	17.52	3.03	5.45
1907	92.00	106.00	35.00	18.00	3.30	7.10
1908	94.00	113.00	36.00	19.00	3.47	7.20
1909	90.00	107.00	36.00	17.50	2.80	6.50
1910	105.00	122.00	38.40	20.10	3.30	8.20
1911	117.00	133.00	48.00	23.50	3.59	9.50
1912	117.00	136.00	53.00	26.70	3.60	8.30
1913	109.00	130.00	53.50	29.20	3.70	9.20
1914	100.00	120.00	62.00	33.00	3.80	10.50
1915	100.00	120.00	72.00	39.30	4.50	10.50
1916	96.00	110.00	69.00	36.30	5.00	8.40
1917	97.00	116.00	67.00	38.10	6.70	10.10
1918	98.00	115.00	72.50	42.10	11.30	17.50
1919	91.00	125.00	79.00	48.20	12.00	18.00
1920	98.00	120.00	93.00	50.50	10.90	17.10
1921	98.00	123.00	91.00	43.38	6.70	13.80
1922	84.00	103.00	73.00	33.35	5.30	11.10
1923	83.00	105.00	73.00	33.48	8.10	11.20
1924	85.00	106.00	73.00	32.43	9.00	10.00
1925	78.00	95.00	70.00	29.66	9.20	9.70
1926	76.00	92.00	73.00	34.91	10.60	14.60
1927	76.00	89.00	75.00	35.58	10.00	15.00
1928	74.00	85.00	80.00	41.97	11.40	13.60
1929	78.00	87.00	94.00	49.08	10.80	12.60

Table 41—Estimated Numbers of Livestock by Counties, January 1, 1928 and 1929

Counties	Horses		Mules		Hogs	
	1928	1929	1928	1929	1928	1929
DISTRICT No. 1—						
Del Norte	500	400	20	20	600	600
Humboldt	5,400	5,300	260	250	5,000	6,000
Mendocino	3,600	3,500	390	380	15,000	14,000
DISTRICT No. 2—						
Shasta	3,500	3,400	300	300	18,000	17,000
Siskiyou	5,700	5,500	420	410	12,000	10,000
Trinity	700	600	130	120	4,000	4,000
DISTRICT No. 3—						
Lassen	5,800	5,600	980	960	3,500	3,300
Modoc	7,600	7,400	850	810	5,000	4,500
Plumas	1,100	1,000	60	50	1,200	1,200
DISTRICT No. 4—						
Alameda	5,400	5,200	100	100	15,000	14,000
Contra Costa	5,200	5,000	400	400	6,500	6,000
Lake	1,400	1,300	240	230	6,000	5,000
Marin	2,100	2,000	80	70	12,000	10,000
Monterey	9,400	9,000	860	850	19,000	16,000
Napa	2,600	2,500	280	280	18,000	17,000
San Benito	3,100	2,900	30	30	4,400	4,400
San Luis Obispo	8,600	8,300	600	600	17,000	16,000
San Mateo	2,300	2,200	50	50	3,200	3,200
Santa Clara	7,800	7,600	400	380	5,000	5,000
Santa Cruz	2,300	2,100	100	90	2,500	2,500
Sonoma	8,600	8,400	390	380	16,000	15,000
DISTRICT No. 5—						
Butte	4,000	3,900	500	480	23,000	25,000
Colusa	2,300	2,200	1,800	1,700	25,000	26,000
Glenn	3,200	3,100	1,500	1,450	19,000	21,000
Sacramento	7,400	7,100	500	450	9,000	9,300
Solano	3,900	3,700	900	850	8,000	9,000
Sutter	2,900	2,800	900	850	12,000	12,000
Tehama	4,300	4,200	1,400	1,350	19,000	18,000
Yolo	5,200	5,000	1,400	1,400	40,000	36,000
Yuba	2,200	2,000	350	340	4,000	4,000
DISTRICT No. 5A—						
Fresno	17,000	16,300	5,000	5,000	18,000	19,000
Kern	8,400	8,000	2,200	2,150	16,000	17,000
Kings	6,200	5,900	1,300	1,250	20,000	23,000
Madera	3,800	3,600	2,100	2,000	12,000	12,000
Merced	7,700	7,300	1,900	1,900	16,000	19,000
San Joaquin	12,700	12,100	1,300	1,300	20,000	24,000
Stanislaus	9,200	9,000	1,500	1,450	15,000	16,000
Tulare	14,000	13,400	4,200	4,200	40,000	44,000
DISTRICT No. 6—						
Alpine	150	150	10	10	200	200
Amador	1,000	950	60	60	4,800	5,000
Calaveras	1,600	1,550	50	50	3,500	4,000
El Dorado	1,600	1,500	100	100	2,000	2,000
Inyo	1,900	1,800	400	400	500	500
Mariposa	1,000	1,000	220	200	4,800	5,000
Mono	750	700	50	50	300	300
Nevada	800	800	50	50	1,800	1,800
Placer	2,800	2,700	300	300	2,800	2,800
Sierra	500	450	20	20	400	400
Tuolumne	1,400	1,300	70	70	3,000	3,000
DISTRICT No. 8—						
Imperial	9,200	9,000	3,800	3,700	33,000	35,000
Los Angeles	9,700	9,300	1,700	1,700	25,000	23,000
Orange	4,000	3,700	2,200	2,150	3,000	3,000
Riverside	8,000	7,600	2,100	2,100	8,000	8,000
San Bernardino	5,500	5,300	1,500	1,500	45,000	44,000
San Diego	7,200	7,000	1,300	1,300	12,000	10,000
Santa Barbara	7,200	7,000	350	350	10,000	9,000
Ventura	6,600	6,400	2,100	2,050	4,000	4,000
Totals	278,000	267,000	52,070	51,040	670,000	670,000

Table 42—January 1 Farm Value of California Live Stock per Head, 1869-1929

Year	Horses, dollars	Mules, dollars	Milk cows, dollars	Other cattle, dollars	Sheep, dollars	Hogs, dollars
1869	$52.71	$73.92	$50.31	$27.86	$2.53	$5.52
1870	36.50	66.66	47.62	26.22	2.56	4.47
1871	50.26	65.64	46.36	26.92	2.59	5.94
1872	43.59	59.76	44.66	23.80	2.78	5.05
1873	44.15	71.06	43.44	22.71	2.97	6.11
1874	47.48	63.74	35.28	19.52	2.31	6.16
1875	41.61	66.49	32.19	18.92	2.53	5.77
1876	45.46	77.20	31.46	20.08	2.02	7.17
1877	39.50	67.75	30.64	16.52	1.40	6.20
1878	40.94	68.98	28.23	17.23	1.52	6.27
1879	43.95	66.24	25.90	18.91	1.61	5.95
1880	46.18	67.54	28.65	18.47	1.62	3.97
1881	45.03	68.79	31.67	20.35	1.70	4.98
1882	47.30	69.20	32.70	21.77	1.65	6.20
1883	54.89	70.98	36.17	27.48	2.02	7.14
1884	61.33	80.18	38.00	29.15	1.90	5.66
1885	62.05	84.30	38.50	30.38	1.89	5.80
1886	63.00	77.65	38.75	28.66	1.81	4.15
1887	64.00	83.67	33.22	20.64	1.77	3.78
1888	71.00	85.03	33.00	20.50	1.88	4.62
1889	70.19	83.78	31.38	19.37	1.88	5.59
1890	63.60	78.21	27.75	16.80	2.08	4.91
1891	67.22	79.41	29.00	17.73	2.20	5.26
1892	62.67	74.72	26.95	17.39	2.42	5.35
1893	57.48	67.90	27.25	17.12	2.32	6.12
1894	41.98	56.38	25.82	16.17	1.81	5.57
1895	31.94	46.25	23.78	15.28	1.65	5.54
1896	27.16	35.02	23.75	15.82	1.85	4.03
1897	27.40	36.89	25.57	16.93	1.86	4.13
1898	28.96	38.33	28.65	18.91	2.23	4.08
1899	27.54	34.15	28.00	18.01	2.64	4.47
1900	38.61	48.49	33.75	24.57	2.85	6.26
1901	49.66	60.44	37.10	22.25	3.00	6.61
1902	56.28	69.23	40.05	23.48	2.90	6.79
1903	60.66	72.02	40.43	24.51	2.92	7.63
1904	65.66	72.68	38.55	21.98	2.75	6.55
1905	67.48	76.39	36.57	19.29	2.67	6.10
1906	76.32	91.30	34.65	17.52	3.03	5.45
1907	92.00	106.00	35.00	18.00	3.30	7.10
1908	94.00	113.00	36.00	19.00	3.47	7.20
1909	90.00	107.00	36.00	17.50	2.80	6.50
1910	105.00	122.00	38.40	20.10	3.30	8.20
1911	117.00	133.00	48.00	23.50	3.59	9.50
1912	117.00	136.00	53.00	26.70	3.60	8.30
1913	109.00	130.00	53.50	29.20	3.70	9.20
1914	100.00	120.00	62.00	33.00	3.80	10.50
1915	100.00	120.00	72.00	39.30	4.50	10.50
1916	96.00	110.00	69.00	36.30	5.00	8.40
1917	97.00	116.00	67.00	38.10	6.70	10.10
1918	98.00	115.00	72.50	42.10	11.30	17.50
1919	91.00	125.00	79.00	48.20	12.00	18.00
1920	98.00	120.00	93.00	50.50	10.90	17.10
1921	98.00	123.00	91.00	43.38	6.70	13.80
1922	84.00	103.00	73.00	33.35	5.30	11.10
1923	83.00	105.00	73.00	33.48	8.10	11.20
1924	85.00	106.00	73.00	32.43	9.00	10.00
1925	78.00	95.00	70.00	29.66	9.20	9.70
1926	76.00	92.00	73.00	34.91	10.60	14.60
1927	76.00	89.00	75.00	35.58	10.00	15.00
1928	74.00	85.00	80.00	41.97	11.40	13.60
1929	78.00	87.00	94.00	49.08	10.80	12.60

Table 43.—Estimated Number, Value per Head and Total Value, of the Different Classes of Live Stock on Farms in California and the United States on January 1, 1920-1929

Item and year	California			United States		
	Number (000) omitted	Value per head	Total value (000) omitted	Number (000) omitted	Value per head	Total value (000) omitted
Horses and colts	1920	402	$98 00	$39,396	19,848	$96 52	$1,915,653
	1921	375	98 00	36,750	19,134	84 57	1,618,120
	1922	360	84 00	30,240	18,564	71 18	1,321,396
	1923	335	83 00	27,805	17,943	70 65	1,267,624
	1924	335	85 00	28,475	17,222	65 48	1,127,619
	1925	314	78 00	24,448	16,470	64 29	1,058,912
	1926	302	76 00	22,938	15,830	65 50	1,036,843
	1927	290	76 00	22,025	15,133	64 14	970,703
	1928	278	74 00	20,554	14,540	67 05	974,855
	1929	267	78 00	20,730	14,029	69 95	981,331
Mules and mule colts	1920	63	120 00	7,560	5,475	148 46	812,828
	1921	60	123 00	7,380	5,586	117 52	656,455
	1922	61	103 00	6,283	5,638	89 14	502,563
	1923	62	105 00	6,510	5,702	87 17	497,044
	1924	59	106 00	6,254	5,730	85 90	492,209
	1925	56	95 00	5,315	5,725	82 73	473,646
	1926	54	92 00	4,964	5,740	81 49	467,760
	1927	53	89 00	4,723	5,652	74 57	421,467
	1928	52	85 00	4,430	5,532	79 71	440,958
	1929	51	87 00	4,427	5,447	82 20	447,727
Milk cows—2 years old and over	1920	515	93 00	47,895	21,427	81 51	1,746,412
	1921	530	91 00	48,230	21,408	61 19	1,309,892
	1922	550	73 00	40,150	21,788	48 68	1,060,574
	1923	580	73 00	42,340	22,063	48 67	1,073,880
	1924	595	73 00	43,435	22,255	49 94	1,111,510
	1925	579	70 00	40,530	22,498	48 39	1,088,597
	1926	596	73 00	43,508	22,188	55 02	1,220,764
	1927	602	75 00	45,150	21,801	59 58	1,299,004
	1928	644	80 00	49,120	21,824	73 93	1,613,373
	1929	626	94 00	58,844	21,820	84 59	1,845,675
All cattle and calves (includes milk cattle)	1920	2,008	61 40	123,291	68,871	52 87	3,641,025
	1921	2,000	56 00	112,000	67,184	39 20	2,633,791
	1922	2,048	44 00	90,112	67,264	30 55	2,054,933
	1923	2,080	44 50	92,560	66,156	31 85	2,107,210
	1924	2,142	43 70	93,605	64,507	32 34	2,086,285
	1925	1,908	41 90	79,945	61,986	31 95	1,980,542
	1926	1,918	46 80	89,657	59,122	37 16	2,196,763
	1927	1,956	47 70	93,327	56,832	40 29	2,289,551
	1928	1,995	53 70	107,076	55,681	51 10	2,845,067
	1929	1,995	64 50	126,033	55,751	59 35	3,308,837
Sheep and lambs	1920	2,900	10 90	31,610	40,243	10 46	420,863
	1921	2,750	6 70	18,425	38,690	6 28	242,781
	1922	2,475	5 30	13,118	36,186	4 80	173,862
	1923	2,600	8 10	21,060	36,212	7 53	272,681
	1924	2,890	9 00	26,010	36,876	7 91	291,626
	1925	3,045	9 20	28,140	38,112	9 70	369,594
	1926	3,200	10 60	34,078	39,730	10 51	417,630
	1927	3,392	10 00	33,806	41,881	9 71	406,588
	1928	3,528	11 40	40,050	44,554	10 25	456,687
	1929	3,846	10 80	41,527	47,171	10 60	500,058
Swine—including pigs	1920	909	17 10	15,544	59,959	20 00	1,199,406
	1921	818	13 80	11,288	58,602	13 65	799,757
	1922	818	11 10	9,080	59,559	10 59	630,935
	1923	818	11 20	9,162	60,044	12 31	849,680
	1924	624	10 00	6,240	66,361	10 30	683,766
	1925	532	9 70	5,160	55,568	13 20	733,742
	1926	468	14 60	6,856	52,148	15 80	824,100
	1927	585	15 00	8,783	54,788	17 25	945,012
	1928	670	13 60	9,144	60,420	13 16	794,941
	1929	670	12 60	8,431	54,956	13 01	714,760

Requests for copies of this report should be addressed to:

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BIENNIAL REPORT

OF THE

SURVEYOR GENERAL

OF THE

STATE OF CALIFORNIA

FOR THE TERM ENDING AUGUST 1, 1928

CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1928

61918

BIENNIAL REPORT OF THE SURVEYOR GENERAL

STATE OF CALIFORNIA,
OFFICE OF THE SURVEYOR GENERAL,
SACRAMENTO, September 7, 1928.

To His Excellency, C. C. YOUNG,
Governor of the State of California.

SIR:

I have the honor to herewith submit a report covering the work of this office for the term ending August 1, 1928.

DURING THE PAST BIENNIUM

Fees and royalties amounting to $12,989 were collected by the Surveyor General and Register of the State Land Office, as provided by sections 501 and 3574 of the Political Code and chapter 303, Statutes of California, 1921, and paid into the state treasury and placed to the credit of the general fund.

15,713 acres of state school lands were leased for a rental of $3,267 under the provisions of chapter 493, Statutes of California, 1917.

34,712 acres of lieu school lands were sold through the sale of scrip purchased under the provisions of section 3408*d* of the Political Code for the sum of $225,628, an average of $6.50 per acre.

Public auction sales of school lands were held under the provisions of chapter 207, Statutes of California, 1919, in the counties of Lake, Los Angeles, Mendocino, Napa, Riverside and San Bernardino, 12,549 acres being sold for $33,096, an average of $2.64 per acre.

421 applications to purchase 48,182 acres of state lands were filed.

1152 reports of county treasurers, made under the provisions of section 3422 of the Political Code, showing the receipt of $120,763.75 paid for state lands, were received and entered on the records of this office, as provided in section 3423 of the Political Code.

7968 acres of lake lands were leased for a rental of $27,684 under the provisions of chapter 612, Statutes of California, 1911.

12 lists and patents conveying 25,620 acres of land from the United States to the state were recorded in this office, as provided in section 3406 of the Political Code.

444 certificates of purchase for 49,995 acres of state lands were issued under the provisions of section 3514 of the Political Code.

468 patents for 69,700 acres of state lands were issued under the provisions of section 3519 of the Political Code.

162 land surveyors' licenses were issued under the provisions of chapter 247, Statutes of California, 1907.

County registrars of land titles in seventeen counties in the state operating under "An act to amend an act entitled 'An act for the certification of land titles and the simplification of the transfer of real estate.' approved March 17, 1897," Statutes of California, 1915, page 1932, reported to this office the number of registrations and of certifi-

cates of title issued, which reports were embodied in reports made by this office under the provisions of chapter 800, Statutes of California, 1917.

17 duplicate certificates of purchase were issued under the provisions of section 3518 of the Political Code.

51 certificates of status of state lands, 108 certified copies of records and 42 certified copies of records of patents were issued.

276 indemnity state selections were made under the provisions of section 3398 of the Political Code.

119 certified lists of lands sold by the state were issued under the provisions of section 3659 of the Political Code.

Surveys, maps and tablings made under the provisions of chapter 612, Statutes of California, 1911, amounting to 5 in number, were checked.

1 survey with map and tabling made under the provisions of chapter 490, Statutes of California, 1915, was checked.

The field notes of the surveys of the areas covered by 104 applications to prospect for oil and gas upon tidelands, under the provisions of chapter 303, Statutes of California, 1921, were checked and platted.

10,000 letters have been written during the two years.

24 lists of persons licensed as land surveyors were transmitted to each of the 58 county recorders in the state as provided by section 4 of chapter 247, Statutes of California, 1907, a total of 1392 lists being transmitted.

Tabulated statements follow:

GENERAL OFFICE BUSINESS

Amount of fees and royalties collected by Surveyor General and Register of the State Land Office from August 1, 1926, to August 1, 1928, and paid into the state treasury, to the credit of the general fund, or to the Secretary of State:

Month	*Paid into state treasury*	*Paid to Secretary of State*
1926—August	$578 62	$38 00
September	358 49	60 00
October	378 35	23 00
November	359 13	12 00
December	1,165 43	26 00
1927—January	888 27	26 00
February	393 66	29 00
March	560 21	34 00
April	388 09	20 00
May	408 69	27 00
June	615 93	14 00
July	323 26	18 00
August	1,039 24	37 00
September	472 34	24 00
October	350 56	32 00
November	269 54	19 00
December	680 97	26 00
1928—January	1,032 67	33 00
February	353 77	23 00
March	314 29	25 00
April	368 12	21 00
May	329 20	16 00
June	376 20	30 00
July	316 63	54 00
Totals	$12,321 66	$667 00

Amount of annual rentals received by the Surveyor General for the lease of state lands pursuant to the provisions of chapter 493, Statutes

of California, 1917, from August 1, 1926, to August 1, 1928, and paid into the state treasury to the credit of the school land fund:

1926—August		$106 00
	December	45 00
1927—January		330 00
	February	147 74
	March	344 30
	April	125 00
	May	34 00
	June	138 00
	July	232 00
	August	131 00
	September	156 00
	December	72 00
1928—January		343 13
	February	175 20
	March	440 30
	April	179 00
	May	46 00
	June	98 59
	July	124 00
Total		$3,267 26

STATE SCRIP

Amount of money received by the Surveyor General from the sale of scrip under the provisions of section 3408*d* of the Political Code, from August 1, 1926, to August 1, 1928, and paid into the state treasury to the credit of the school land fund:

1926—August		$3,245 46
	September	2,071 16
	October	17,515 22
	November	8,588 58
	December	24,285 04
1927—January		10,936 51
	February	4,898 08
	March	3,656 58
	April	10,307 33
	May	16,622 52
	June	7,346 90
	July	21,544 47
	August	12,470 83
	September	7,679 88
	October	4,619 62
	November	6,045 47
	December	650 00
1928—January		11,106 55
	February	7,631 20
	March	2,338 57
	April	13,311 68
	May	9,090 00
	June	14,918 48
	July	4,747 60
Total		$225,627 73

Amount of money received by the Surveyor General under the provisions of chapter 303, Statutes of California, 1921, for application fees for permits, permit fees, and royalties, and paid into the state treasury to the credit of the school fund:

Application fees for permits	$15 00
Permit fees	429 01
Royalties	4,544 41
Total	$4,988 42

FINANCIAL RECAPITULATION

Amount of fees and royalties collected by Surveyor General and Register of the State Land Office	$12,321 66
Amount of fees collected by Register of State Land Office for Secretary of State	667 00
Amount of annual rentals received by Surveyor General for the lease of state land under chapter 493, Statutes of California, 1917	3,267 26
Amount of money received by Surveyor General from the sale of scrip under section 3408*d* of the Political Code	225,627 73
Amount of money received by the Surveyor General under the provisions of chapter 303, Statutes of California, 1921, for application fees for permits, permit fees, and royalties	4,988 42
Total	$246,872 07

PUBLIC AUCTION SALES OF SCHOOL LANDS

State school lands were sold at public auction under the provisions of chapter 207, Statutes of California, 1919, between August 1, 1926, and August 1, 1928, as follows:

County	*Date*	*Acres*	*Amount*
Lake	August 8, 1927	200	$400 00
Los Angeles	August 5, 1927	114	3,854 00
Mendocino	August 16, 1927	480	960 00
Napa	August 19, 1927	409	817 00
Riverside	August 25, 1927	5,162	14,292 00
San Bernardino	August 3, 1927	6,184	12,773 00
Totals		12,549	$33,096 00

APPLICATIONS TO PURCHASE STATE LANDS

From August 1, 1926, to August 1, 1928, applications to purchase state lands were received and filed as follows:

School lands and swamp and overflowed lands	*Number of applications*	*Acres*
Los Angeles Land District, school lands	279	25,656.99
Sacramento Land District, school lands	121	20,813.87
San Francisco Land District, school lands	10	904.90
Visalia Land District, school lands	6	720.00
Swamp and overflowed lands	5	86.40
Totals	421	48,182.16

STATE LAND PAYMENTS

Amounts of principal, interest and penalties received for the state by the county treasurers, on account of sales of school lands, from August 1, 1926, to August 1, 1928.

County	*Principal*	*Interest*	*Total*	*Penalties*
Alameda				
Alpine	$800 00	$429 62	$1,229 62	
Amador		5 40	5 40	
Butte		162 70	162 70	
Calaveras	120 00	183 60	303 60	
Colusa				
Contra Costa				
Del Norte		162 00	162 00	$3 24
El Dorado	40 80	311 41	352 21	46
Fresno		992 58	992 58	49 66
Glenn		9 50	9 50	95
Humboldt	784 80	49 80	834 60	
Imperial	3,244 00	6,194 47	9,438 47	571 86
Inyo	243 00	823 25	1,066 25	84 96
Kern	6,290 32	5,603 26	11,893 58	191 80
Kings	146 76	578 33	725 09	8 02
Lake	40 00	282 43	322 43	16 74
Lassen	144 00	9,560 54	9,704 54	55 04
Los Angeles	925 43	2,141 10	3,066 53	69 32
Madera		363 36	363 36	
Marin				
Mariposa		203 28	203 28	
Mendocino	2,000 12	1,053 14	3,053 26	16 29
Merced		100 80	100 80	
Modoc	640 00	647 16	1,287 16	5 18
Mono	5,158 75	1,337 22	6,495 97	44 76
Monterey	3,432 61	1,832 94	5,265 55	89 52
Napa	296 88	72 20	369 08	44
Nevada		58 80	58 80	2 80
Orange				
Placer		17 86	17 86	3 62
Plumas	320 00	44 80	364 80	
Riverside	8,382 35	5,916 32	14,298 67	341 62
Sacramento				
San Benito	598 02	790 63	1,388 65	30 48
San Bernardino	13,801 59	13,867 92	27,669 51	553 60
San Diego	2,224 80	3,960 55	6,185 35	302 40
San Francisco				
San Joaquin				
San Luis Obispo	640 00	2,636 68	3,276 68	125 51
San Mateo				
Santa Barbara				
Santa Clara		109 14	109 14	86
Santa Cruz				
Shasta	280 00	782 72	1,062 72	35 19
Sierra				
Siskiyou	669 55	694 82	1,364 37	6 92
Solano				
Sonoma		177 41	177 41	3 42
Stanislaus		134 40	134 40	
Sutter				
Tehama	1,728 00	650 84	2,378 84	25 92
Trinity	528 00	74 02	602 02	5 28
Tulare	202 85	430 44	633 29	1 24
Tuolumne		58 40	58 40	2 38
Ventura		59 00	59 00	5 48
Yolo	278 44	83 96	362 40	24 34
Yuba	166 40	307 18	473 58	1 00
Totals	$54,127 47	$63,955 98	$118,083 45	$2,680 30

Amount of annual rentals received for the leasing of state lands pursuant to the provisions of chapter 612, Statutes of California, 1911, from August 1, 1926, to August 1, 1928, and paid into the state treasury to the credit of the school land fund by the lessees was $27,684.16.

Amount of annual rentals received for the leasing of state lands pursuant to the provisions of chapter 829, Statutes of California, 1921, from August 1, 1926, to August 1, 1928, and paid into the state treasury to the credit of the general fund by the lessees was $946.

Amount of annual rentals received for the leasing of state lands pursuant to the provisions of chapter 330, Statutes of California, 1923, from August 1, 1926, to August 1, 1928, and paid into the state treasury to the credit of the general fund was $40.

Amount of annual rentals received for the leasing of state lands pursuant to the provisions of chapter 121, Statutes of California, 1925, from August 1, 1926, to August 1, 1928, and paid into the state treasury to the credit of the school land fund was $938.75.

LEASING OF STATE LANDS

The number of acres of state lands which were leased from the State of California from August 1, 1926, to August 1, 1928, are as follows:

	Acres
State lands leased pursuant to the provisions of chapter 612, Statutes of California, 1911	7,968.05
State lands leased pursuant to the provisions of chapter 493, Statutes of California, 1917	15,713 06
Total	23,681.11

LANDS LISTED TO THE STATE

From August 1, 1926, to August 1, 1928, lands were listed to the State of California by the United States, as follows:

Grant	*Acres*
Indemnity or lieu lands	25,140.14
Swamp and overflowed lands	480.00
Total	25,620.14

CERTIFICATES OF PURCHASE ISSUED

(From August 1, 1926, to August 1, 1928)

Grant	*Number of certificates*	*Acres*
Sixteenth and thirty-sixth sections and indemnity or lieu lands	444	49,203.43
Swamp and overflowed lands	6	791.39
Totals	450	49,994.82

PATENTS ISSUED

(From August 1, 1926, to August 1, 1928)

	Number of patents	*Acres*
Sixteenth and thirty-sixth sections and indemnity or lieu lands	459	69,246.25
Swamp and overflowed lands	9	453.79
Lake lands	3	133.72
Totals	471	69,833.76

LAND SURVEYORS LICENSED

Licenses issued to land surveyors from August 1, 1926, to August 1, 1928, numbered 162.

LAND TITLE LAW

September 7, 1928.

Pursuant to the provisions of chapter 800, Statutes of California, 1917, I beg to report that according to reports received, certificates of title have been issued pursuant to the registration of land titles under "The Torrens Law" in eighteen of the fifty-eight counties, as follows:

Alameda County—165 certificates issued up to August 1, 1928.
Fresno County—23 certificates issued up to August 1, 1928.
Humboldt County—223 certificates issued up to August 1, 1928.
Imperial County—373 certificates issued up to August 1, 1928.
Inyo County—5 certificates issued up to August 1, 1928.
Kern County—60 certificates issued up to August 1, 1928.
Los Angeles County—51,124 certificates issued up to August 1, 1928.
Orange County—5049 certificates issued up to August 1, 1928.
Riverside County—193 certificates issued up to August 1, 1928.
San Bernardino County—2302 certificates issued up to August 1, 1928.
San Diego County—3622 certificates issued up to August 1, 1928.
San Francisco County—9 certificates issued up to August 1, 1928.
San Luis Obispo County—3 certificates issued up to August 1, 1928.
Santa Barbara County—406 certificates issued up to August 1, 1928.
Santa Cruz County—10 certificates issued up to August 1, 1928.
Sonoma County—296 certificates issued up to August 1, 1928.
Tulare County—54 certificates issued up to August 1, 1928.
Ventura County—1 certificate issued up to August 1, 1926. No report was received from the registrar of titles in Ventura County for the year 1927–1928.

The Torrens act provides that upon the original registration of any land, a sum equal to one-tenth of one per cent of the assessed value of the land including permanent improvements thereon as the same were valued for county taxation the last time said land and permanent improvements or either thereof were assessed for county taxes next preceding the filing of the petition shall be collected by the registrar and paid to the State Treasurer to be credited to the "Torrens Title Assurance Fund." The books of the State Treasurer show that on August 1, 1928, the "Torrens Title Assurance Fund" contained State of California Harbor Improvement 4 per cent bonds having a face value of $28,000, which were purchased for the benefit of said fund, for the sum of $27,308.23, and that the amount of cash in said fund on August 1, 1928, was $1,352.52.

Respectfully submitted.

W. S. Kingsbury,
Surveyor General.

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FOURTH ANNUAL REPORT

OF THE

State Board

OF

Chiropractic Examiners

OF THE

State of California

TO THE GOVERNOR

1926-1927



CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1927

55098

FIFTH ANNUAL REPORT OF THE STATE BOARD OF CHIROPRACTIC EXAMINERS

For the Fiscal Year Ending June 30, 1927.

APPLICATIONS FOR LICENSURE.

There were [illegible] applications for licensure received for filing during the year. This was [illegible] less than the number received during the seventy-seventh year and [illegible] less than the seventy-sixth year.

RECIPROCITY.

The board has established reciprocal agreements with Arizona, Oregon, Montana, Nebraska, Oklahoma, Kansas, Tennessee and Maryland.

There have been 7 applications for licensure by reciprocity received during the past year. Of this number 2[illegible] have been favorably considered. Forty-eight are now pending action by the board.

Of the twenty-one favorably considered, each applicant had an original license granted by examination in the state from which he came. The candidates were found from the following states:

Arizona	1
Iowa	1
Kansas	4
Maryland	1
Nebraska	4
Oklahoma	3
Oregon	1
Tennessee	1
Total	21

While there have been 21 persons licensed by reciprocity and 48 applications are now pending, there have been 69 denied, in other cases on the recommendation of this board.

These were as follows:

Maryland	1
Nebraska	4
Oregon	1
Oklahoma	2
Total	28

We have no data available that would show how many applications for licensure are pending in other states from the members of this board.

MEETINGS.

The board meetings for the past have been five in number. The place and date of each is as follows:

July 13-14, 1926 (examination)	San Francisco
September 1-4, 1926	Los Angeles
November 29-30, 1926	Sacramento
January 10-11, 1927 (examination)	Los Angeles
February 28, 1927	Sacramento

At the two statutory meetings examinations were held. The following tables contain the data:

SECTION V.

Date	Number participating	Number passed	Number failed
January 13, 1927	177	113	64

SECTION VIII.
(Practical and Clinical.)

Date	Number participating	Number passed	Number failed
July 14, 1926	4	4	0

SECTION V.

Date	Number participating	Number passed	Number failed
January 11, 1927	143	83	60

SECTION VIII.

Date	Number participating	Number passed	Number failed
January 12, 1927	1	1	0

NOTE.—Since the establishment of this department, there have been 2188 persons licensed to practice chiropractic in the State of California. Of this number, there are, at this time, 2101 persons who hold unrevoked certificates.

Hearings Before the State Board of Chiropractic Examiners.

Name	Charge	Disposition
Chas. Brockman	Insufficient educational qualifications	Charges dismissed
Margaret Hallquist	Insufficient educational qualifications	Denied licensure
Frederick J. Oakes	Illegal advertising	Found not guilty
Wm. P. Seibert	Fraud or deception in application	Found guilty. Denied licensure
Charles H. Wood	Fraud or deception in application	Found guilty. License revoked November 20, 1926
Cecile Zicklin	Insufficient educational qualifications	Denied licensure

LEGAL DEPARTMENT.

Writs.

Title of action		Nature of action and status
Berkeley College of Chiropractic vs. State Board of Chiropractic Examiners	Supreme Court, San Francisco, No. 12009, on appeal Superior Court, San Francisco, No. 162818	Action for injunction against the Board to enjoin the Board from making investigations of chiropractic schools and colleges. This matter is now on appeal to the Supreme Court from a judgment of the Superior Court, San Francisco, against the Board. In the Superior Court, since its judgment, two attempts have been made to enforce the injunction pending appeal, to wit: On December 15, 1926, an order to show cause in contempt was issued. This order to show cause was discharged after hearing on January 7, 1927. Also, On January 11, 1927, an order to show cause in contempt was issued. After several hearings, this order to show cause was discharged on February 7, 1927.
P. Parviance vs. State Board of Chiropractic Examiners	Supreme Court, San Francisco, No. 12550 Superior Court, San Francisco, No. 162818	Action for injunction against the Board to prevent the hearing thereby of charges to revoke plaintiff's license to practice. This cause is now on appeal from from a judgment denying injunction. In the Superior Court, two attempts were made to enforce a temporary restraining order, to wit: On November 9, 1926, an order to show cause was issued, citing the Board for contempt. This order to show cause was discharged on November 20, 1926. Also, On March 15, 1927, an order to show cause in contempt was issued. After two hearings, this order to show cause was discharged on March 29, 1927.

Writs—Continued.

Title of action		Nature of action and status
P. Purviance vs. State Board of Chiropractic Examiners	Superior Court, San Francisco, No. 166283	Action for accounting to require repayment of expenditures made by the Board. Complaint was filed on February 13, 1926. On July 8, 1926, the Board's demurrer to the complaint was sustained with leave given to plaintiff to amend. An amended complaint was filed on February 17, 1927. On March 19, 1927, the Board's demurrer to the amended complaint was sustained without leave to amend, and judgment entered for defendant.
C. H. Wood vs. State Board of Chiropractic Examiners	Superior Court, Los Angeles, No. 212072	Petition for writ of review to vacate order of the Board revoking the petitioner's license to practice. Judgment entered for petitioner restoring his license. Appeal not taken.
State Board of Chiropractic Examiners vs. Superior Court, Los Angeles county	Supreme Court, San Francisco, No. 12339	Petition for a writ of prohibition to prohibit the Superior Court, Los Angeles County, from issuing its writ of review in the matter of Wood vs. Board; Superior Court, No. 212072. Writ denied.
People, etc., ex rel. State Board of Chiropractic Examiners vs. Berkeley Chiropractic College	Superior Court, Alameda County, No. 89519	Action in quo warranto to annul the corporate capacity of the Berkeley Chiropractic College. Cause is at issue and ready for trial.
People, etc., ex rel. State Board of Chiropractic Examiners vs. Berkeley Chiropractic High School	Superior Court, Alameda County, No. 89520	Action in quo warranto to annul the corporate capacity of the Berkeley Chiropractic High School. Cause is at issue and ready for trial.

Writs—Continued.

People, etc., ex rel. State Board of Chiropractic Examiners vs. L. D. Harding	Superior Court, San Francisco. No. 170739	Action for injunction against illegal practice of medicine by a chiropractic licentiate. A demurrer to the original complaint was sustained with leave given to amend the complaint. The complaint was amended and a demurrer thereto was filed. The demurrer to the amended complaint was overruled. The time given to file an answer to the amended complaint has not expired at the date of this report.
Evelyn Coleman-Olsen vs. State Board of Chiropractic Examiners	District Court of Appeal; First Appellate District, Division One, No. 5901	Petition for a writ of prohibition filed June 25, 1927, seeking to prohibit the Board from hearing charges filed with them against the petitioner.

Mr. Frank V. Kington, the board's legal counsel, in commenting upon the legal situation, says:

"By way of comment, permit me to state that the most important of the litigation in which the board is involved at this time is the matter of 'People of the State of California, ex rel. State Board of Chiropractic Examiners, plaintiff, against L. D. Harding, defendant. Superior Court, San Francisco, No. 1707039.

"This is a proceeding designed to have the scope of chiropractic practice under the terms of the chiropractic act judicially determined and also, to develop the principle of stopping unlawful practice by means of injunction. This cause presents two questions thusly; neither of which have been finally determined in California.

"The results of this cause when the same is finally determined will include an elimination of the existing cleavage in chiropractic ranks and make the practices uniform and within law. Another salutary feature, if the case for the people succeeds, will be the development of a new, effective and durable means of stopping illegal practices in all professions that concern health. It is well recognized that criminal prosecutions do not produce permanent results; and that injunctions will."

CITATIONS.

Name	Place-date	Charge	Disposition
M. A. Buchner	San Francisco, November 16, 1926	Cited to appear before district attorney because of use of word "Physician" in connection with Chiropractic.	Signs had been removed prior to appearance.
J. W. Dodson	Oakland, August 9, 1926	An osteopath, cited to appear before the district attorney because of having word "Chiropractor" upon his windows.	Told to remove signs, with warning that second offense would result in arrest.
James Esperence	Alameda, August 23, 1926	Cited to appear before district attorney because of advertising chiropractic in connection with I-ON-A-CO.	Claimed he did not read ads sent to newspapers, and swore he did not use chiropractic in any form. Dismissed with warning that if he advertised chiropractic in future, prosecution would follow.
Simion Zwerling	San Francisco, November 16, 1926	Cited to appear before district attorney because of use of phrase "Chiropractic Physician" in advertising.	Upon appearance it was shown that sign had been removed.

PROSECUTIONS.

Title of action	Place-date	Charge	Disposition
People vs. Stanford E. Bell	Los Angeles May 26, 1927	Practicing chiropractic without a license.	Trial set for July 19.
People vs. N. C. Burwash	Burbank July 3, 1926	Practicing chiropractic without a license.	Complaint filed, trial set for July 7, 1926. Found guilty of advertising as a chiropractor without having a license. Fined $50. Fine suspended so long as he did not engage in the practice of chiropractic or advertise as a chiropractor.
People vs. Chase Carrall	Taft March 18, 1927	Practicing chiropractic without a license.	Plead not guilty, March 26, 1927. Case dismissed for lack of evidence.
People vs. Chester C. Cook	Watsonville January 25, 1927	Practicing chiropractic without a license.	Plead not guilty, February 3, 1927. Case dismissed provided defendant discontinued practice.
People vs. Fred C. Crow	San Pedro September 8, 1926	Practicing chiropractic without a license.	Plead guilty, November 5, 1926. Fined $200 with 90 days suspended jail sentence.
People vs. Jake G. Gloeckler	Shafter January 19, 1927	Practicing chiropractic without a license.	Found guilty. Fined $50 with 60 days suspended jail sentence, February 2, 1927.
People vs. Amelia Grimley	Bakersfield, January 20, 1927	Practicing chiropractic without a license.	Found guilty, practicing chiropractic without a license and for using the letters "D. C." Fined $50 and given suspended jail sentence of 30 days, February 11, 1927.
People vs. F. S. Haynes	South Pasadena July 1, 1926	Practicing chiropractic without a license.	Found guilty, July 2, 1926. Fined $100 and 60 days in county jail, with $50 of fine suspended and all of jail sentence. Put on probation until such time license is secured.

PROSECUTIONS—Continued.

Title of action	Place-date	Charge	Disposition
People vs. Mrs. Harry Heaton	Bishop March 16, 1927	Practicing chiropractic without a license and using title "D. C."	March 17, 1927, found guilty and fined $50 on each count and given 20 days jail sentence, all sentences suspended provided she file application with the Board and take the July examination.
People vs. Albert Holloway	Los Angeles April 15, 1927	Practicing chiropractic without a license.	May 4, 1927, found guilty. Fined $50 and 30 days in jail. Jail sentence and $25 of fine suspended.
People vs. Thomas C. Kean	Los Angeles October 12, 1926	Practicing chiropractic without a license.	Found guilty. Fined $50 and 10 days in jail, with jail sentence suspended, December 6, 1926.
People vs. W. E. and Carrie Moyer	Santa Cruz August 4, 1926	Practicing chiropractic without a license.	Warrant for arrest could not be served, as they had left for parts unknown. Judge stated he would give them a suspended sentence provided they quit practice if they returned to Santa Cruz.
People vs. A. W. Olson	Turlock June 16, 1927	Practicing chiropractic without a license.	Found guilty. Fined $25.
People vs. Alla Phillips	Los Angeles March 1, 1927	Practicing chiropractic without a license.	March 28, 1927, plead guilty. Fined $35 and 30 days in county jail. Jail sentence suspended.
People vs. Mary O. Post	Merced December 3, 1926	Use of word "Chiropractor" in advertising, without a license.	December 10, 1926, plead guilty. Fined $50.
People vs. B. A. Seelau	Long Beach October 27, 1926	Practicing chiropractic without a license.	November 3, 1926, plead not guilty. Case dismissed for lack of evidence.
People vs. H. Sornsen	Los Angeles February 21, 1927	Practicing chiropractic without a license.	April 4, 1927, plead guilty. Fined $100 and fifty days in jail. Sentence suspended so long as he does not practice.

PROSECUTIONS—Continued.

Title of action	Place-date	Charge	Disposition
People vs. A. M. Welden	Santa Rosa March 7, 1927	Practicing chiropractic without a license.	June 14, 1927, case dismissed.
People vs. T. L. Wilson	Brawley May 6, 1927	Practicing chiropractic without a license.	Found guilty. Fined $50. $25 of fine suspended provided he make application to the Board for examination.
People vs. E. F. Dierks	San Diego December 2, 1926	Practicing chiropractic without a license.	February 5, 1927, trial postponed. Defendant called to Nebraska by illness in family.

CHANGE OF NAME.

Five licentiates have recorded a change of name by marriage during the past fiscal year, and corresponding entry was made in our records.

Former name	*Present name*	*Change made in our records*
Elizabeth Bush	Elizabeth Halloran	September 13, 1926
Ada L. L. Marshall	Ada M. Fry	January 10, 1927
Kathryn M. Rhodes	Kathryn M. Douglass	September 30, 1926
Maude J. Smith	Maude Fuller	September 30, 1926
Jennie L. Tracy	Jennie L. Taylor	September 4, 1926

LOSS OF LICENSE.

A new license was issued to Carleton McKee Merrill, who attested that his original license certificate was destroyed by fire. New license issued September 4, 1926.

REGISTERED CHIROPRACTORS DECEASED.

Anderson, Ludwig W.
Barfield, Estelle
Bassett, James E.
Cloes, Augustus B.
Courdway, John William
Graham, Clarence Edwin
Horner, Frank S.
McBride, Arthur G.
Nebel, John B.
Schwab, Reuben Philip
Strayer, William A.
Wren, Earl C.

FORFEITURE OF LICENSE.

On March 2, 1926, there were 80 persons who forfeited their licenses through nonpayment of the annual renewal fee. Of this number 47 have since had their licenses restored. Those having their licenses restored since the date of last report are:

Batchelder, Gertrude M.
Broadwell, Alice E.
Campbell, Agnes C.
Courtney, J. Fred
Crow, Thomas B.
Davis, Ramon Stevens
Drennan, Valla H.
Graham, Beulah M.
Higby, Lawrence G.
Lochridge, Cassie Wood
Lyons, Martha E.
Miller, Fred C.
Nelson, Eivind M.
Troeger, Richard A.
Worthington, Byron G.

The following named persons forfeited their licenses March 2, 1926, and have applications for restoration now pending:

Harvey, Elizabeth J.
Miller, Jessie G.

On March 2, 1927, 32 persons forfeited their licenses for failure to pay the annual tax. The names of these persons are as follows:

Albert, George
Barker, Myrtle B.
Bishop, Wilfred
Bowman, Ruby M.
Brown, Jacob Rhodes
Christenson, Albert F.
Clark, Francis J.
Douglass, Bird
Durant, J. Marshall
Edwards, Homer W.
Gilmore, Lillian W.
Gilmore, Lynn D.
Hartford, Anna C.
Hudson, C. C. Olis
Jahn, Pauline
Jordan, George W.
Letson, Samuel B.
Long, Russell
Meade, Esther Mabel
Molony, Wm. John
Orco, James J.
Pennington, Ruth E.
Pringle, Roy Joseph
Richmond, Fred C.
Scoville, Nellie A.
Shane, Raymond L.
Solid, George L.
Sturgis, Josiah R.
Taylor, Alice Viola
Taylor, Paul A.
Turnbull, Emma M.
Willes, Gladys Morning

Below are the names of those presons who forfeited their licenses March 2, 1927, for nonpayment of the renewal fee, and whose applications for restoration are now pending:

Albert, George
Barker, Myrtle B.
Bowman, Ruby M.
Pringle, Roy Joseph
Richmond, Fred C.
Scoville, Nellie A.
Turnbull, Emma M.

Summary.

Total number of licenses forfeited, 1927	32
Number forfeited, 1926, and still unrestored	33
Total number of persons without licenses because of failure to pay the annual tax	65

Statement of Income for the Period July 1, 1926, to June 30, 1927, of the Seventy-eighth Fiscal Year.

Application fees—	
Examination	$4,950 00
Reciprocity	525 00
Renewal fees	4,034 00
Reinstatement fees	150 00
Reindorsement of certificates	150 00
Total income	$9,809 00

Statement of Expenditures for the Period July 1, 1926, to June 30, 1927, of the Seventy-eighth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration—					
Board members		$150 00			$150 00
Clerical and office	$54 07	2,387 66	$9 20	$166 70	2,617 63
Freight, cartage and express			25 52		25 52
Janitor			104 28		104 28
Postage			250 00		250 00
Printing	322 88				322 88
Rent			657 58		657 58
Secretary		1,000 00	25 00		1,025 00
Telephone and telegraph			305 41		305 41
Traveling			138 71		138 71
	$376 95	$3,537 66	$1,515 70	$166 70	$5,597 01
Examinations—					
Board members		$170 00			$170 00
Engrossing certificates			$23 20		23 20
Rental			240 00		240 00
Correcting examination papers			502 96		502 96
Traveling			207 06		207 06
		$170 00	$973 22		$1,143 22
Investigations, Revocations and Prosecutions—					
Board members		$210 00			$210 00
General expense			$148 60		148 60
Legal services			1,304 11		1,304 11
Reporting hearings			546 48		546 48
Special agents		3,189 00			3,189 00
Traveling—					
Board members			266 97		266 97
Special agents			1,187 71		1,187 71
		$3,399 00	$3,453 87		$6,852 87
Grand totals	$376 95	$7,106 66	$5,942 79	$166 70	$13,593 10

55098 10-27 3150

ISTICAL REPORT

OF

AU OF PURCHASES

STATE OF CALIFORNIA

FOR THE

78TH AND 79TH FISCAL YEARS
JULY 1, 1926, TO JUNE 30, 1928

Submitted to the
Division of Service and Supply
DEPARTMENT OF FINANCE

BY

W. G. McMILLIN, State Purchasing Agent

STATISTICAL REPORT

OF

BUREAU OF PURCHASES

STATE OF CALIFORNIA

FOR THE

78TH AND 79TH FISCAL YEARS
JULY 1, 1926, TO JUNE 30, 1928

Submitted to the
Division of Service and Supply
DEPARTMENT OF FINANCE

BY

W. G. McMILLIN, State Purchasing Agent

65070

OFFICE ORGANIZATION

WARREN G. McMILLIN, State Purchasing Agent

J. F. Mispley ..... Deputy

L. E. Hobart (in charge of San Francisco branch and stores) ..... Assistant

Grant Goodale (in charge of Los Angeles branch) ..... Assistant

Gus H. Brudigan ..... Buyer

Chas. L. Peters ..... Buyer

Lowell R. Smith ..... Buyer

Mrs. M. L. Johnson ..... Secretary and Assistant Buyer

Frank J. Lewis (Sacramento) ..... Storekeeper

Wm. L. Meuser (San Francisco) ..... Storekeeper

COMMODITY DIVISIONS

Division 1—Groceries, produce, meats and provisions; all food and forage supplies; and all special contracts, handled by W. G. McMillin and assistant buyer.

Division 2—Stationery, office supplies and equipment, printing supplies, furniture and household equipment, carpets and floor coverings, crockery and tableware, handled by J. F. Mispley.

Division 3—Dry goods, clothing, boots, shoes, leather and shoe findings, drugs, chemicals, scientific and surgical equipment, paints and oils, handled by Gus H. Brudigan.

Division 4—General hardware and plumbing supplies, electrical goods, lumber and builder's hardware, farm machinery, kitchen equipment, etc., handled by Chas. L. Peters.

Division 5—Highway and road building material and equipment, automotive equipment, cement, rock and sand, lubricating and burning oils, heavy machinery and equipment, handled by Lowell R. Smith.

REPORT OF STATE PURCHASING AGENT

I herewith submit report of the Bureau of Purchases for the seventy-eighth and seventy-ninth fiscal years, beginning July 1. 1926, and closing June 30, 1928.

The sequence, in which the various matters treated of in this report will appear, is as follows:

First—Total value of all purchases for all departments, commissions, and institutions, showing the total expenditures through the purchasing bureau.

Second—The report of the San Francisco branch of the bureau, and the purchases through that branch for the Harbor Commission.

Third—The report of the purchases made by the Los Angeles branch of the purchasing bureau.

Fourth—The total business done in the stores and distribution activities in San Francisco, Los Angeles, and Sacramento.

Fifth—The total cost of the bureau in the function of purchasing.

Sixth—Cost of operating the stores and distribution of merchandise from stores in Sacramento, San Francisco, and Los Angeles.

Respectfully submitted.

W. G. McMILLIN,
State Purchasing Agent.

PURCHASES DURING 78th AND 79th FISCAL YEARS ARRANGED AS TO DEPARTMENTS AND INSTITUTIONS

	Agnew State Hospital	Mendocino State Hospital	Napa State Hospital	Norwalk State Hospital	Stockton State Hospital	Patton State Hospital	Industrial Home for Adult Blind	Sonoma State Home	Veterans' Home of California	San Quentin Prison	Folsom State Prison	California School for Deaf and Blind	Ventura School for Girls	Preston School of Industry	Whittier State School	Pacific Colony	Department of Finance: Bureau of Printing	Department of Finance: Division of Motor Vehicle	Department of Public Works: Highway	Department of Public Works: Division of Architecture and other Divisions	Sundry departments including State colleges	Totals	
1. Groceries	$32,768 18	$29,822 57	$50,942 85	$36,065 92	$72,435 31	$60,000 84	$6,148 81	$52,650 24	$34,775 80	$99,989 06	$38,609 62	$11,516 67	$8,873 90	$26,918 85	$16,737 28	$4,170 63			$73,625 93	$1,675 97	$6,008 26	$684,748 63	1
2. Produce and dried fruit	34,203 10	10,650 01	21,416 18	18,515 75	31,817 75	34,279 41	2,030 60	30,204 45	13,562 41	76,340 55	42,198 38	3,240 74	5,840 19	13,799 23	8,618 27	992 39			13,855 68	137 54	4,075 48	326,740 02	2
3. Meat and provisions	149,005 01	71,669 65	194,993 02	88,294 67	162,518 60	174,880 87	13,021 76	113,304 74	61,000 00	275,858 55	119,629 06	31,377 52	19,728 04	52,532 87	38,130 06	7,282 34			58,370 64	961 32	15,835 43	1,569,556 50	3
4. Flour and cereals	53,513 89	25,923 43	51,479 87	27,208 24	57,765 53	45,901 30	1,831 45	43,464 85	9,230 05	89,917 79	31,720 27	2,922 96	2,475 19	16,182 29	8,476 65	2,045 58	84 25		5,465 76	18 10	3,758 15	477,541 24	4
4a. Milk	43,550 00						2,912 00					14,227 50			19,044 37				660 90		1,007 40	81,402 17	4a
5. Grains and feed	14,843 06	24,473 44	31,352 65	34,895 41	37,604 02	42,023 85		47,749 35	34,349 42	19,735 17	19,317 01	288 34	8,169 00	21,897 02	2,099 80	1,416 28			9,699 17		10,447 17	355,677 46	5
6. Fresh fish	9,856 00	3,470 00	15,384 00	1,657 50	13,670 00		876 20		6,604 00	2,449 40	19,382 02	97 50	960 00	870 00	515 00	1,780 00	462 50		250 00		3,703 16	82,973 28	6
7. Tobacco	7,728 91	7,474 54	8,571 25	3,482 16	13,535 62	8,885 81			929 08	881 41	27,911 88	16,118 85							6,658 27	34 00	1,759 30	110,903 28	7
8. Soaps and laundry supplies	7,355 11	5,703 15	6,734 34	7,220 43	7,810 50	8,596 50	405 09	10,159 87	3,497 47	10,589 65	4,256 69	671 55	2,217 81	4,690 85	3,586 22	777 17	17 25	57 75	3,065 05	3 15	5,732 36	93,336 06	8
9. Brooms and brush manufacturing material	65 99	67 35	1,424 70	478 12	280 00	257 83	38,878 81	832 76	84 02	521 40		276 86	17 20	94 49					4,445 35		1,447 70	48,950 58	9
10. Coal and wood	702 15	42 12	2,913 63	34 00	8,661 20	81 10	87 05	3,700 15	2,015 05	7,562 86	2,232 12	235 00	50 00	3,503 99					9,063 21	781 97	4,922 38		10
11. Clothing, hats, dry goods and tent awnings	39,480 68	20,227 10	54,093 91	40,594 71	59,253 14	40,050 78	1,832 12	51,026 42	48,394 25	206,075 77	74,487 37	2,919 64	8,856 93	45,683 97	17,325 05	7,109 11	1,824 51	822 60	10,547 54	2,867 27	17,597 48	615,283 43	11
11a. Clothing and shoes, San Quentin manufacture	9,561 64	5,852 52		1 00				14 10			100 00	28 60	18 25						21 80	5 50	394 38		11a
12. Hose, belting, packing and miscellaneous rubber goods	1,340 00	1,318 34	2,596 71	544 80	2,370 71	1,114 10	23 45	3,530 61	935 33	8,277 80	1,348 26	184 35	275 90	2,074 79	811 15	279 73			3,324 61	2,309 91	9,356 99	42,515 75	12
13. Leather sheets and findings	3,202 08	3,023 27	6,399 84	3,517 56	6,268 84	7,634 21	20 00		4,152 88	35,145 77	8,145 33	1,009 86	2,984 14	16,953 39	4,965 06	1,235 09	37 50		325 00		1,755 00	117,539 09	13
14. Drudery and shakeout	701 43	711 02	1,666 84	1,956 57	3,864 89	3,658 77	181 08		742 41	4,179 44	748 99	1,009 01	565 62	2,523 23	1,674 14	573 39			750 91		188 50		14
15. Kitchen equipment	7,207 49	3,491 41	3,117 66	7,873 38	13,066 55	9,453 61	119 47	7,729 56	2,874 89	6,140 53	3,409 72	1,169 73	1,241 85	2,936 46	2,983 40	1,145 56	12 00	46 75	18,780 13	83 64	7,444 74	104,777 63	15
16. Furniture and carpets	21,111 23	14,315 48	8,661 74	10,505 14	25,022 66	13,055 03	151 96	10,467 30	10,335 58	3,889 03	8,381 66	6,109 89	376 15	7,546 06	5,031 46	9,801 72		9,208 99	12,120 06	68,221 65	42,481 53	206,412 65	16
17. Stationery, school, janitor, office supplies equipment	4,559 52	5,812 88	1,453 20	4,015 92	8,071 90	4,555 93	1,318 75	8,298 90	3,412 22	24,982 55	8,052 84	5,003 79	2,090 52	3,701 64	3,941 59	8,067 17	2,237 30	83,731 55	74,656 88	22,721 89	43,661 97	219,000 43	17
18. Drugs, chemicals and hospital supplies	8,878 48	4,635 32	14,796 26	18,751 38	11,986 09	10,408 92	471 23	14,160 88	4,333 96	14,537 34	9,442 31	2,026 15	2,801 15	10,663 75	1,308 01	559 37			6,777 57		68,942 93	266,254 86	18
19. Fuels, oils, etc	4,819 96	2,512 85	10,149 65	4,669 69	8,462 32	7,466 82	291 06	8,791 06	1,893 00	10,228 43	5,827 00	387 84	561 16	2,668 76	3,729 48	52 34	54 70	120 30	21,427 21	39,692 26	58,379 49	197,906 33	19
20. Belting and supplies	2,267 23	1,202 00	3,000 00	1,000 00	3,000 00	1,000 00	100 00	3,000 00	1,000 00	3,000 00	1,000 00	300 00	1,000 00	3,000 00	1,000 00	300 00	1,500 00	300 00	1,486,894 55	9,983 78	3,445 44	1,527,695 48	20
21. Electrical supplies	7,243 40	4,007 46	4,040 70	3,452 71	7,311 30	3,330 80	148 96	5,588 17	7,424 16	9,216 15	4,180 65	1,551 85	390 50	3,232 12	1,911 09	1,286 65			7,587 24	2,902 15	54,247 55	91,380 69	21
22. Paints and paints	2,564 02	25 12	279 17	114 65	304 97	313 25			233 55	95 50			3 11	64 65	6 50				1,285 15			5,291 67	22
23. Dental supplies	1,022 11	43 19	316 57	772 80	759 17	250 15			242 26		6,871 12	6,187 94		135 04	1,219 50	161 96	706 24					21,456 60	23
24. Shoes	714 40	1,197 94	583 75	790 99	118 34	750 31			94 45	16 33	3,449 49	2,052 36	14 56	60 45	512 02	43 87	335 00		1,302 55		364 17	12,001 51	24
25. Sporting goods	97 60								389 62				113 32	71 96	2,225 97	1,302 55			364 17			5,831 29	25
26. Printing supplies			105 88	43 60	17 75				72 88		7,510 53	2,230 83	4,468 59	1,864 10		4,682 50	616,437 32				70,000 00	707,424 75	26
27. Lithographing and embossing, etc	32 12			43 50							57 50						3,018 25	2,295 63	1,093 34		8,455 76	15,393 36	27
28. Live stock	1,417 50	3,811 98	1,385 00	8,510 20	480 00	1,021 00			1,052 00	1,590 00	833 00	1,567 50		340 00	1,127 20	380 00	786 00						28
29. Automobiles and trucks	3,597 46	1,340 00	1,628 18	1,533 50	1,047 84	1,425 00	850 00		3,851 00	3,160 00	6,986 80				9,007 87				12,536 40	666,874 45	21,649 41	184,491 78	29
30. Auto accessories	651 32	122 48	99 52	154 65	47 70	746 00			355 04	30 45	481 57	130 71	45 21	32 75	1,342 37	258 32	193 20		203 41	85,206 25	3,825 49	4,148 17	30
31. Automobile tires and tubes	749 05	215 93	664 14	488 66	505 26	1,368 16	40 80	671 07	557 42	1,436 08	670 03	48 28	580 93	1,745 08	738 81	242 83	93 53	2,033 41	67,572 76	2,028 82	1,570 26	19,124 34	31
32. Stationery, stock, seeds, etc	2,921 51	1,499 51	2,490 38	1,858 78	3,533 93	7,059 26		1,591 94	1,187 47	1,910 87	1,742 50	432 25	920 49	2,157 08	2,007 85	1,151 23			1,570 26	2,028 82	18 00	10,041 21	32
33. Musical instruments	350 00	910 00							310 04	690 50		1,686 52	37 50	2,045 20	265 00							6,264 26	33
34. Machinery and equipment	20,588 58	8,005 76	10,502 72	7,312 18	3,686 95	10,016 88	4,257 94	9,877 50	4,158 11	19,899 08	16,903 71	338 65	1,728 65	5,766 42	7,832 22	8,426 05	64 10	120 00	764,678 19	21,455 83	20,602 00	34
35. Building material	955 10	104 45	1,685 13	217 52	906 11	117 55			960 62	885 96	639 25	31 82		640 14	120 00	37 20	165 41	1,326 06	26,910 12	28,766 23	10,999 35	35	
36. Lumber	4,969 49	2,549 35	12,429 59	3,336 65	7,387 33	5,123 61			7,468 45	2,660 31	38,776 62	8,810 52	237 81	391 52	10,086 91	4,007 47	1,139 81		50,015 25	105,597 71	24,187 56	36	
37. Cement	1,138 80	42 30	1,241 24	875 25	2,191 94	3,829 00			5,399 55	1,252 25	4,918 95	2,010 71		16 20	2,053 40	210 65			2,307 54		2,307 54	37	
38. License plates, badges, etc																		375,016 24	117 50		117 50	375,251 24	38
39. Explosives								134 13	76 35	604 25	320 04			3 50					1,115 00	114 15	2,100 00	4,453 42	39
40. Rock, sand and gravel	1,539 50	242 48	833 26	1,343 13	1,063 20	178 70			1,788 95	2,940 50	879 80	208 87	21 00	480 32	232 66				233,092 19	532 63		245,553 51	40
41. Culverts								60 38	381 27										1,015 94	1,015 94		2,473 53	41
42. Miscellaneous	2,810 79	1,819 93	6,113 38	4,751 75	6,536 69	12,048 99	388 21	5,054 25	3,770 03	14,257 78	7,032 64	1,131 05	1,897 10	3,057 90	2,742 02	3,307 02	2,634 11	144 15	31,907 70	52,102 12	24,739 60	183,445 60	42
43. Jute										583,115 00												583,115 00	43
44. Blanket and confirmatory	6,220 00	4,209 00	4,550 00	8,450 00	9,350 00	5,550 00	6,710 00	5,605 00	5,350 00	4,711 72	8,400 00	14,040 00	933 00	6,532 00	5,142 25	6,150 00	28,500 00	10,000 00	95,000 00	42,658 37	358,300 14	639,110 48	44
Totals	$567,333 41	$311,071 69	$618,023 32	$387,609 74	$650,044 56	$570,702 76	$91,689 43	$532,783 01	$311,113 57	$1,778,377 74	$534,466 23	$125,204 43	$78,834 17	$326,318 56	$177,554 78	$77,185 60	$665,486 36	$597,903 37	$3,018,195 81	$1,250,130 62	$1,247,440 59	13,230,081 59	
Total purchases for Harbor Commission, (see Table II for classification)																						$15,027,653 42	
Grand total																							

In this table is shown the total values of each line of commodities purchased for each of the institutions and larger departments as indicated at the top of the column. The total for each institution or department is indicated by the amount at the bottom of each column, and the total purchase in each line of commodity is shown by the figures in the last column on the right of the total opposite the commodity on lines numbered from one to forty-three, and the footing of the last column indicates the grand total or value of all purchases for all institutions, departments and offices of the state.

Permit me to call your attention to the marked increase in our purchases over the last biennium. The total purchases for the preceding biennium was $11,313,590.50, while the total for the present biennium is $18,027.635.42. This is an increase of $6,714,044.92, or approximately sixty per cent increase in the quantity of business going through the purchasing bureau.

There are two causes for this increase—the natural growth of the institutions and departments, and the fact that all purchases for the Division of Highways are now being handled by the bureau, and the unusual increase of the activities of the Highway Division over the last year of the biennium. Doubtless this extended program will continue during the next several years, hence, we confidently expect no decrease in the quantity of business, but on the contrary there will probably be a further increase aside from the natural growth of the institutions during the coming biennium.

To give some idea of the increase in business in the purchasing bureau, I would call your attention to the increased number of requisitions and purchase orders:

Requisitions worked July 1, 1926, to July 1, 1927	24,571	
Requisitions worked July 1, 1927, to July 1, 1928	39,512	
Increase for one year		14,941
Purchase orders issued July 1, 1926, to July 1, 1927	38,242	
Purchase orders issued July 1, 1927, to July 1, 1928	54,124	
Increase for one year		15,882

The above shows very clearly an increase in number of documents going through the bureau, commensurate with the increase in volume expressed in dollars and cents, and further indicates that the most of this increase occurred in the last year of the biennium, and is therefore a reflection of the extended and intensive program of the Highway Division. It is also an indication of a continuance of these activities and expenditures over a period of years sufficient to complete the highway program.

TABLE NO. II

PURCHASES BY THE HARBOR COMMISSIONER BRANCH

July 1, 1926, to July 1, 1928

This gives the total purchases made through the San Francisco branch of the purchasing bureau under supervision of Mr. L. E. Hobart, with the total value of each of the major commodity classifications, and the total of all commodities.

1.	Automobiles and auto trucks	$11,353 67
2.	Automobile tires and tubes	2,061 73
3.	Automobile accessories, repairs and parts	3,467 81

4. Bolts:			
a. Carriage, stove and plow (list and discount)	$251 74		
b. Machine, regular sizes (list and discount)	1,517 93		
c. Machine, large sizes (per cwt.)	10,093 55		
d. Miscellaneous	2,570 50		
		$14,433 72	
5. Building materials and specialties:			
a. Asbestos bearing cement, green label	$920 00		
b. Asbestos pipe covering, sheet asbestos	813 30		
c. Lime, mortar, plaster, plastering fibre	317 77		
d. Marble, tile and chimneys	3,025 71		
e. Miscellaneous	366 59		
f. Preservatives, wood and metal, creosote	10,458 74		
g. Ready roofing, roofing felts, building paper	2,028 32		
h. Rock, sand and gravel	15,624 49		
		33,554 92	
6. Cement		132,299 46	
7. Chemicals, acids and laboratory supplies		1,745 28	
8. Clay products:			
a. Brick, common and fire	$578 39		
b. Building tile (partition)	4 62		
c. Fire clay, fire brick cement	104 86		
d. Vitrified sewer pipe	238 61		
		926 48	
9. Coal, coke and charcoal		1,240 68	
10. Electrical supplies:			
a. Conduit	$7,724 49		
b. Illuminating fixtures, etc., reflectors, flashlights, street lighting fixtures	10,298 87		
c. Electric lamps	4,656 54		
d. Miscellaneous	1,254 22		
e. Switches, panels, cabinets, controllers, commutators	6,094 14		
f. Wiring devices, and material for same	5,055 74		
g. Electrical motors, generators, commutators and repairs for same, electrical equipment	874 84		
		35,958 84	
11. Hardware:			
a. Hand tools, axes, hammers, saws, wrenches, files, hacksaw blades, soldering irons, rasps, pliers, screw drivers, ship augers, bit braces	$3,115 80		
b. Shovels, picks, adzes, pike poles, sledges, mauls, peavies, hoes, asphalt tamping irons	543 54		
c. Builders' hardware, screws, nuts, rivets, cotters, metal washers, hinges, butts, pile dog studs	6,774 73		
d. Handles, all kinds	382 33		
e. Miscellaneous	7,292 09		
f. Ship chandlery	2,498 25		
		20,606 74	
12. Hose packing, belting, rubber and leather goods, belt lacing, gaskets, hose fittings and gloves		2,676 63	
13. Hospital supplies		245 92	
14. Janitor supplies and chemicals for janitor use:			
a. Brushes, brooms, handles for same	$901 56		
b. Chemicals and soaps for cleaning and polishing, disinfectants	1,622 82		
c. Miscellaneous	769 57		
d. Paper towels and toilet paper	1,922 75		
e. Rags and waste, mop yarn, mop handles	2,101 19		
		7,317 99	
15. Lumber:			
a. Creosoted lumber	$10,861 23		
b. Hardwood	5,067 47		
c. Millwork	609 04		
d. Green piling	12,019 76		
e. Creosoted piling	319,366 43		
f. Softwood	218,504 40		
g. Railroad ties	4,222 93		
		570,651 26	
16. Machinery and equipment, including repairs for same:			
a. Boilers	$1,146 18		
b. Machine tools, lathes, shapers, drill presses, etc.	6,312 49		
c. Miscellaneous	10,658 86		
d. Office furniture, fixtures, typewriters, adding machines, floor covering	4,582 31		
e. Portable air and electrical driven tools, such as drills, grinders, riveters, etc.	3,929 13		
f. Road machinery and street sweeping equipment	4,139 34		
g. Special apron handling designs, etc.	6,358 00		
h. Woodworking equipment	13 90		
		37,140 21	

17. Metals:			
a. Iron and steel castings and forgings	$1,347 40		
b. Iron and steel plates, bars, structural shapes including tool steel	6,939 09		
c. Iron and steel sheet, black and galvanized and blue annealed	11,032 16		
d. Nonferrous metals, brass, copper, babbit, solder, etc.	2,601 82		
		$21,920	47
18. Miscellaneous		2,577	77
19. Office supplies and drafting room supplies		4,160	81
20. Blueprints and films		1,788	15
21. Oxygen and acetylene:			
a. Gas	$2,714 96		
b. Supplies and equipment	568 77		
		3,283	73
22. Oil and oil products:			
a. Asphaltic cements	$2,068 69		
b. Diesel oil	297 03		
c. Fuel oil	124,417 92		
d. Gasoline, kerosene, distillate, signal oil	7,288 78		
e. Lubricating oil, grease, graphite	3,147 08		
f. Street asphalt (hot)	17,344 78		
		154,564	28
23. Paints, supplies and glass:			
a. Brushes	$1,097 74		
b. Colors, dry and in oil	437 36		
c. Mixed paints, enamels, washable wall paints	2,949 47		
d. Glass, all kinds	2,854 27		
e. Linseed oil, turpentine, shellac, varnish, etc.	3,161 12		
f. Pigment, red lead, white lead, whiting, etc.	7,463 30		
g. Miscellaneous, wood filler, tallow, wax, putty	501 78		
		18,465	04
24. Plumbing and steam supplies:			
a. Fixtures, plumbing, sinks, lavatories, etc.	$1,743 50		
b. Pipe fittings, cast and malleable	10,320 71		
c. Steam specialties	231 11		
d. Tubes (boiler and condenser stray bolts)	139 49		
e. Valves (all kinds), parts for same	1,337 73		
f. Miscellaneous	968 69		
		14,741	23
25. Railroad specialties:			
a. Parts and repairs for railroad equipment	$6,977 34		
b. Rolling stock; locomotives, cars, tires, etc.	4,937 52		
c. Rails, frogs, switches, joints, etc.	134,908 66		
d. Railroad spikes and bolts, plates, tie rods	11,938 40		
		158,761	92
26. Rope and twine, manila and cotton, B.C., etc.:		**13,353**	**72**
27. Wire products:			
a. Nails, brads, spikes, staples	$7,607 37		
b. Wire rope, clips, thimbles	5,289 31		
c. Electric wire, rubber covered, W. P. cable	9,901 32		
d. Wire, black, galvanized, brass, gutter broom	126 15		
e. Wire cloth, hardware cloth, screens, etc.	862 28		
		23,786	43
		$1,293,084	79

TABLE III

Purchases made by the Los Angeles office from July 1, 1926, to July 1, 1928

Subsistence	$57,677 65
Grain and feed	26,916 29
Hose, belting and miscellaneous rubber goods	937 79
Crockery and glassware	2,038 61
Kitchen equipment	4,553 94
Furniture and carpets	43,153 20
Stationery	7,745 52
Hospital and drug supplies	4,241 29
Paint and oils	14,759 06
Oils, burning and lubricating	18,855 44
Plumbing and hardware	78,278 56
Electrical supplies	14,129 44
Dental supplies	948 71
Sporting goods	1,349 20
Live stock	8,945 00
Automobiles and accessories	34,290 25
Machinery and equipment	17,309 26
Farm implements	2,534 62
Building materials	94,589 49
Lumber	88,083 49
Miscellaneous	137,909 72
Totals	$659,246 44

This table gives the total purchases made by the Los Angeles office of this bureau operated under the supervision of Mr. Grant Goodale.

It must be borne in mind that this does not indicate the total purchases made by the bureau in the Los Angeles market, but only that portion where it is not deemed necessary to secure quotations from markets outside of Los Angeles. All large contracts and purchases of large quantities of merchandise on which it is deemed advisable to secure competitive prices from other markets than Los Angeles, are handled by the main office and prices requested from dealers and manufacturers located in the several large trade and manufacturing centers, and awards are made to the lowest and best bidders, transportation and cost of delivery considered.

We recently compiled a list of figures showing awards made to the bidders in Los Angeles and vicinity, which showed business amounting to approximately $1,632,304.84 during this biennium. This business was awarded in the main office to the Los Angeles section in competition with prices secured from other sections. Add this to the purchases made by the Los Angeles office, and it gives the total placed in the southern metropolis of approximately $2,291,551.28.

It is not consistent with economy of operation for our office to keep accurate records showing quantity of business placed with each wholesale center. We have no interest in the distribution of the business of the State of California from a sectional or geographical point of view. All we are concerned with is to give every reliable concern, which has filed with us a request to bid, a chance to present his proposition, and fair treatment in the awards, based upon price, quality and service, is given all. We did, however, as above set forth, make a partial survey of awards at the request of our Los Angeles representative.

This survey shows that in proportion of state population of wards in institutions located in the south, the Los Angeles bidders are getting about their proportion of the entire business, as the highway intensive program has been confined almost entirely to the northern end of the state during the last summer, the winter program being emphasized in the south.

TABLE IV

Sales, Stores Division, July 1, 1926, to July 1, 1928

1926:	
July	$31,302 69
August	18,917 25
September	26,465 25
October	27,778 05
November	13,954 60
December	24,129 31
1927:	
January	42,243 23
February	14,936 62
March	37,087 36
April	24,568 15
May	20,293 80
June	32,751 52
Total	$314,427 83
July	$22,654 89
August	19,372 08
September	36,385 64
October	29,685 96
November	23,276 77
December	26,059 74

1928:	
January	$42,789 26
February	14,906 09
March	35,906 66
April	38,287 22
May	26,677 43
June	40,350 18
Total	$356,351 92
Total two years	$670,779 75

The foregoing table shows the total sales from our stores in Sacramento, San Francisco and Los Angeles for the entire biennium. (Location of stores—Capitol, Sacramento; Ferry Building, San Francisco; Associated Realty Building, Los Angeles.) In billing these goods to the various institutions and departments, we have added to our cost laid down in our stores, approximately 5 per cent, to cover handling and distribution costs, keeping separate the function of purchasing and the function of stores and distribution.

TABLE V

Cost of Operation of the Purchasing Function, July 1, 1926, to July 1, 1928

Main office:		
Printing		$5,186 75
Salaries		95,008 25
Fixtures		634 44
Supplies		1,787 90
Postage		7,518 80
Traveling expenses		2,367 95
Telephone and telegraph		4,635 35
Automobile		1,734 44
Testing charges		989 39
Miscellaneous		557 81
Total cost of purchasing function		$120,421 08
Total purchases		$18,027,635 42

Percentage of cost of operating purchasing function, .67 per cent.

The above table shows the cost of operating the function of purchasing the vast amount of merchandise shown in Table I, also percentage of cost based upon total business performed.

TABLE VI

Cost of Operating Stores and Distribution, July 1, 1926, to July 1, 1928

Salaries all stores	$31,655 55		
Freight and drayage	4,389 93		
Material and supplies	170 55		
Equipment	58 03		
Total		$36,374 06	
Total amount of business done by stores		670,779 75	
Gross cost of operating stores	$36,274 06		
Cash discount two years	3,909 08		
Net cost	$32,364 98	=	4.67 %

In above table is shown cost of operation of the stores of this bureau as well as cost of distribution; also, percentage of cost of stores and distribution as based upon the total business done.

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THIRD ANNUAL REPORT

OF THE

STATE ATHLETIC COMMISSION

OF

CALIFORNIA

TO THE

GOVERNOR

AND TO THE

LEGISLATURE OF THE STATE OF CALIFORNIA

For the Period Commencing December 1, 1926
to November 30, 1927



56841

THIRD ANNUAL REPORT

OF

STATE ATHLETIC COMMISSION OF CALIFORNIA.

To the Honorable C. C. YOUNG,
Governor of State of California, and
To the Legislature of the State of California:

Pursuant to the provisions of section 2 of an act approved by the electors of the State of California on November 4, 1924, entitled, "An act to authorize boxing and wrestling contests," the State Athletic Commission of California presents herewith the third annual report of its proceedings and activities beginning on the first day of December, 1926, and ending November 30, 1927.

Since the creation of this Commission, January 1, 1925, the sum of $416,079.91 has been paid into the state treasury from the 5 per cent state tax imposed upon boxing and wrestling clubs and the license fees of referees, managers, boxers, seconds, trainers, timekeepers, physicians and wrestlers.

In this period of time (three years) the operating expenses of the Commission amounted to $77,387.06, so the State of California has profited to the extent of $338,692.85 from the Boxing Law. The money thus collected can go for no other purpose according to the initiative measure than the erection and maintenance of California veterans' homes.

The legislature at its last session appropriated $171,000 from the Athletic Commission Fund for the erection of barracks at the Veterans' Home at Yountville. Construction of these barracks will begin about March 1, 1928.

COMMISSION RECEIPTS.

The receipts of the Commission for the third fiscal year were $135,298.36, which is somewhat less than the receipts for the first and second fiscal years, due to the fact that several more out-door shows were held in the two previous years than in the one just passed.

The monthly detailed report of the Commission's receipts is given herewith:

1926—December	$12,078 16
1927—January	13,191 04
February	11,278 27
March	13,575 92
April	10,279 01
May	8,499 64
June	9,450 14
July	12,411 66
August	12,552 50
September	10,682 30
October	8,857 46
November	12,482 26
Total	$135,298 36

BOX OFFICE RECEIPTS.

It may be interesting to know that during the third fiscal year the sum of $2,449,026.62 was paid into the box offices of the various boxing and wrestling clubs in California, segregated monthly as follows:

1926—December	$145,031 85
1927—January	162,694 51
February	185,249 75
March	234,938 26
April	214,405 53
May	170,125 35
June	198,055 11
July	245,349 86
August	246,119 58
September	209,535 27
October	169,984 59
November	267,537 01
Total	$2,449,026 62

ATTENDANCE.

During this same period 1,695,749 people passed through the gates of the boxing and wrestling clubs in California, as the monthly record of attendance shows:

1926—December	108,241
1927—January	118,657
February	128,731
March	170,944
April	141,613
May	127,106
June	114,565
July	152,250
August	169,690

September	149,804
October	127,434
November	156,714
Total	1,695,749

SHOWS HELD.

Following is the number of shows held in California monthly during the period covered in this report:

1926—December	81
1927—January	75
February	82
March	108
April	105
May	98
June	102
July	92
August	98
September	103
October	93
November	98
Total	1,135

Every one of the above shows was held under the direct supervision of the Athletic Commission with a state boxing inspector in charge as required by law. These contests have been entirely free from brutality, and in every instance the official referees, under direction of the Commission, have promptly terminated all contests when it became apparent that the contestants were unevenly matched. Boxers are subjected to a thorough physical examination eight hours before the contest and physicians are in attendance at the ringside at all times when a boxing contest is in progress, empowered to order the referee to end the bout before anything serious might happen.

LICENSES ISSUED.

All licenses issued by this Commission are given out and based on a calendar year, from January 1, 1927, to November 30, 1927, the following number of licenses being issued—to wit:

Clubs (boxing and wrestling)	81
Referees	70
Managers	319
Boxers	2,125
Seconds	518
Timekeepers	55
Physicians	68
Trainers	1
Matchmakers	15
Wrestlers	79

FINES.

Section 10 of the initiative measure, "The referee shall have power in his discretion to declare forfeited any prize, remuneration or purse, or any part thereof, belonging to the contestants or one of them, or any part of the gate receipts for which said contestants are competing, if in his judgment such contestant or contestants are not honestly competing."

In accordance with the power given the referees under the law, the sum of $1,240.82 was declared forfeited and the same has been deposited to the credit of the State Athletic Commission Fund with the State Treasurer.

The sum of $3,070 has been imposed upon clubs, boxers, managers, seconds and others in fines, in addition to suspension for infractions of the rules of the Commission. This also has been deposited to the credit of the State Athletic Commission Fund with the State Treasurer.

SUSPENSIONS.

The following shows that 338 suspensions were imposed upon those connected with the boxing and wrestling game and the reasons therefor:

Non-appearance	105
Ill and unavailable	82
Fouling	50
Stalling and rough tactics	35
Physically unfit	30
Infraction of commission rules	25
Accused of crime	9
Under 18 years of age	2
Total suspensions	338

This is a very creditable showing considering the fact that there were 1135 shows and an average of ten to twelve boxers participated at each contest. As noted above 82 of the 338 suspensions were on account of the boxers being ill and unavailable, and 30 physically unfit.

In formulating rules and regulations deemed necessary by the Commission for a proper enforcement of the law, the safety and convenience of the public has always been uppermost in the minds of the Commismissioners. Boxing and wrestling today is in as healthy and sound a condition as it ever was, due to the continual demand on the part of this Commission for respect and obedeince to the rules and regulations. The greatest evil of all, betting, it is gratifying to report, has been reduced to practically a minimum by the enactment of a rule prohibiting certain known undesirable characters admission to club premises and holding licensed clubs to strict accountability for a rigid enforcement of the same.

$40,000 APPROPRIATED.

Section 15 of the initiative boxing and wrestling act reads: "All moneys to the amount of forty thousand dollars annually are hereby appropriated to be used to defray the expenses of the Commission and to pay the salaries of the officers and employees provided for herein."

The detailed financial statement of this report shows that the sum of $33,787.72 was spent in the defraying of salaries and expenses of the Commission for the third fiscal year which is $6,212.28 less than the legal amount that may be expended in one fiscal year.

FINANCIAL REPORT.

Appended hereto and transmitted herewith is a financial report of the third fiscal year from December 1, 1926, to November 30, 1927.

STATEMENT OF INCOME.

5% state tax	$102,297 54
Club licenses	4,765 00
Referee licenses	1,700 00
Manager licenses	7,775 00
Boxer licenses	10,760 00
Second licenses	2,330 00
Physician licenses	355 00
Timekeeper licenses	255 00
Trainer license	5 00
Matchmaker licenses	375 00
Wrestler licenses	370 00
Fines	3,070 00
Purses confiscated by referee	1,240 82
Grand total	$135,298 36

STATEMENT OF EXPENDITURES.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Clerical and office	$1,952 29	$3,600 00	$1,841 46	$2,703 08	$10,096 83
Automobile	23 06		350 59		373 65
Traveling			2,862 01		2,862 01
Rent			2,910 00		2,910 00
Postage			605 78		605 78
Telephone and telegraph			1,663 90		1,663 90
Total administration expense	$1,975 35	$3,600 00	$10,233 74	$2,703 08	$18,512 17
Inspections:					
Inspectors		$6,200 00	$8,627 48		$14,827 48
Traveling			442 02		442 02
Telephone and telegraph			6 05		6 05
Total inspection expense		$6,200 00	$9,075 55		$15,275 55
Total administration expense	$1,975 35	$3,600 00	$10,233 74	$2,703 08	$18,512 17
Total inspection expense		6,200 00	9,075 55		15,275 55
Total of expenses	$1,975 35	$9,800 00	$19,309 29	$2,703 08	$33,787 72

STATEMENT OF ATHLETIC COMMISSION FUND.

State Athletic Commission Fund	$338,442 85	
Administration	18,512 17	
Inspections	15,275 55	
Revolving Fund	250 00	
Departmental income		$135,208 36
Accumulated excess income		237,182 21
Totals	$372,480 57	$372,480 57

All of which is respectfully submitted.

STATE ATHLETIC COMMISSION OF CALIFORNIA.
LOUIS ALMGREN, Chairman,
SETH W. P. STRELINGER, Commissioner,
CHAS. F. TRAUNG, Commissioner.

WALTER A. YARWOOD, Secretary.

o

FIRST ANNUAL REPORT

OF THE

State Board of Barber Examiners

OF THE

State of California

TERM ENDING JUNE 30, 1928

MEMBERS OF BOARD

JOSEPH T. HAYWOOD, *President*----------San Francisco
C. L. BUTTS, *Director of Examinations*----------Los Angeles
C. E. RYNEARSON, *Secretary*----------Marysville

Address 428 State Office Building, Sacramento, California

61344

FIRST ANNUAL REPORT

OF THE

STATE BOARD OF BARBER EXAMINERS

OF

CALIFORNIA

To the Honorable C. C. YOUNG,
Governor of State of California, and
To the Legislature of the State of California:

Pursuant to the provisions of section 21, chapter 853, Statutes of 1927, approved on May 31, 1927, an act governing the practice of barbering in the State of California, the State Board of Barber Examiners presents herewith the first annual report of its activities and proceedings beginning on the twenty-second day of August, 1927, and ending on June 30, 1928.

Up to and including June 30, 1928, the board has collected a sum of $51,607, which has been deposited into the state treasury in a fund known as the State Board of Barber Examiners' Fund. This amount is the receipts of fees on apprentice licenses, barber licenses, apprentice examinations, barber examinations and educational tests as provided for in the California barber law.

In this period of time the operating expenses of the board were $26,215.42. Thirty examinations have been held throughout the State since the first examination on January 4, 1928. There have been one hundred and sixty-six shops closed temporarily in the State on account of insanitary conditions. We are proud to report that the majority of these shops are again operating in accordance with the sanitary requirements. Four hundred and two barbers in this state have refused to apply for license owing to the fact that they were drug users or had some communicable disease and could not make the necessary affidavit in order to qualify for license.

The monthly detailed report of the board's receipts follows:

1927		
SEPTEMBER:		
Barber licenses (blanket form)	$4,200 00	
Apprentice licenses (blanket form)	9 00	
		$4,209 00
OCTOBER:		
Barber licenses (blanket form)	$27,614 00	
Apprentices licenses (blanket form)	307 00	
		27,921 00
NOVEMBER:		
Barber licenses (blanket form)	$1,388 00	
Apprentice licenses (blanket form)	30 00	
Apprentice examinations	25 00	
Journeyman examination with permit	720 00	
Journeyman examination without permit	80 00	
		2,243 00
DECEMBER:		
Barber licenses (blanket form)	$96 00	
Apprentice licenses (blanket form)	5 00	
Apprentice examinations	30 00	
Journeyman examination with permit	1,340 00	
Journeyman examination without permit	10 00	
Educational test examinations	27 00	
		1,508 00
1928		
JANUARY:		
Barber licenses	$146 00	
Apprentice licenses	2 00	
Apprentice examinations	90 00	
Journeyman examinations with permit	2,890 00	
Journeyman examinations without permit	80 00	
Educational test examinations	144 00	
		3,352 00
FEBRUARY:		
Barber licenses	$438 00	
Apprentice licenses	2 00	
Apprentice examinations	60 00	
Journeyman examinations with permit	2,230 00	
Journeyman examinations without permit	290 00	
Educational test examinations	72 00	
		3,092 00
MARCH:		
Barber licenses	$172 00	
Apprentice licenses	19 00	
Apprentice examinations	100 00	
Journeyman examinations with permit	1,980 00	
Educational test examinations	84 00	
Journeyman examinations without permit	530 00	
		2,885 00
APRIL:		
Barber licenses	$174 00	
Apprentice licenses	16 00	
Apprentice examinations	95 00	
Journeyman examinations with permit	1,240 00	
Journeyman examinations without permit	1,000 00	
Educational test examinations	78 00	
		2,603 00
MAY:		
Barber licenses	$312 00	
Apprentice licenses	23 00	
Apprentice examinations	190 00	
Journeyman examinations with permit	740 00	
Journeyman examinations without permit	550 00	
Educational test examinations	117 00	
		1,932 00
JUNE:		
Barber licenses	$594 00	
Apprentice licenses	34 00	
Apprentice examinations	145 00	
Journeyman examinations with permit	1,020 00	
Educational test examinations	69 00	
		1,862 00
		$51,607 00

Following is a detailed report of expenditures from September, 1927, to December, 1927, inclusive, and January 1 to June 30, 1928, inclusive:

Function	Material and supplies	Salaries and wages	Service and expense	Property and equipment	Sub-total	Gross total
ADMINISTRATION—						
Board members	$14 70	$3,870 98	$320 69	--------	$4,206 37	
Clerical and office	263 83	1,045 00	53 13	$573 97	1,935 93	
Postage	-------	----------	805 00	--------	805 00	
Printing	1,232 34	----------	--------	--------	1,232 34	
Miscellaneous	-------	----------	25 00	--------	25 00	
Extra help	-------	464 00	--------	--------	464 00	
Rent	-------	----------	165 00	--------	165 00	
						$8,833 64
January, 1928—						
Administration	558 37	1,269 00	122 44	1,869 28	3,819 09	
Investigations	-------	----------	192 31	--------	192 31	
Examinations	-------	----------	40 00	--------	40 00	
						4,051 40
February, 1928—						
Administration	89 90	1,225 00	107 66	135 12	1,557 68	
Investigations	-------	----------	914 04	--------	914 04	
Examinations	-------	----------	448 00	--------	448 00	
						2,919 72
March, 1928—						
Administration	6 64	1,247 00	105 56	--------	1,359 20	
Investigations	-------	----------	87 20	--------	87 20	
Examinations	-------	----------	6 00	--------	6 00	
						1,452 40
April, 1928—						
Administration	3 35	1,220 50	82 25	233 55	1,539 55	
Investigations	-------	----------	577 68	--------	577 68	
Examinations	-------	----------	48 00	--------	48 00	
						2,165 33
May, 1928—						
Administration	9 15	1,325 80	34 80	--------	1,369 75	
Investigations	-------	----------	4 03	--------	4 03	
Examinations	-------	----------	476 00	--------	476 00	
						1,849 70
June, 1928—						
Administration	215 44	1,350 00	404 20	705 53	2,675 17	
Investigations	-------	----------	1,480 06	--------	1,480 06	
Examinations	-------	----------	787 92	--------	787 92	4,943 15
	$2,393 72	$13,017 28	$7,286 97	$3,517 45		$26,215 42

You will note in the foregoing report of expenditures that from September to December 31, 1927, inclusive, we have covered the entire expenses under the various items under administration up to January 1, 1928, when we began making our monthly statements.

STATEMENT OF INCOME

September 16, 1927, to June 30, 1928, Inclusive

Journeyman examinations with permits	$12,160 00
Barber licenses	35,134 00
Educational tests	591 00
Journeyman examinations without permits	2,540 00
Barber student examinations	140 00
Apprentice licenses	447 00
Apprentice examinations	595 00
	$51,607 00

STATEMENT OF EXPENDITURES

September 16, 1927, to June 30, 1928, Inclusive

Function	Material and supplies	Salaries and wages	Service and expense	Property and equipment	Total
ADMINISTRATION—					
Board members	$14 70	$9,270 98	$432 37		$9,718 05
Clerical and office	365 64	3,220 80	73 05	$3,517 45	7,176 94
Postage			1,025 89		1,025 89
Printing	2,013 38				2,013 38
Miscellaneous			29 80		29 80
Extra help		525 50			525 50
Rent			550 00		550 00
Cartage and express			12 00		12 00
Telephone and Telegraph			102 62		102 62
	$2,393 72	$13,017 28	$2,225 73	$3,517 45	$21,154 18
EXAMINATIONS—					
Traveling expenses			418 42		418 42
Rent			1,351 50		1,351 50
Assistants			20 00		20 00
Typing questions			16 00		16 00
			$1,805 92		$22,960 10
INVESTIGATIONS			3,255 32		3,255 32
	$2,393 72	$13,017 28	$5,061 24	$3,517 45	$26,215 42

All of which is respectfully submitted.

STATE BOARD OF BARBER EXAMINERS
OF CALIFORNIA

J. T. Haywood, President

C. L. Butts, Director of Examinations

C. E. Rynearson, Secretary

o

61344 8-28 1,650

SECOND ANNUAL REPORT

OF THE

State Board of Barber Examiners

OF THE

State of California

TERM ENDING JUNE 30, 1929

MEMBERS OF BOARD

JOSEPH T. HAYWOOD, *President*.....San Francisco
C. L. BUTTS, *Director of Examinations*.....Los Angeles
C. E. RYNEARSON, *Secretary*.....Marysville

Address 428 State Office Building, Sacramento, California

70119

SECOND ANNUAL REPORT OF THE STATE BOARD OF BARBER EXAMINERS OF CALIFORNIA

To the Hon. C. C. Young,
Governor of State of California, and
To the Legislature of the State of California.

Pursuant to the provisions of section 21, chapter 853, Statutes of 1927, approved on May 31, 1927, an act governing the practice of barbering in the State of California, the State Board of Barber Examiners presents herewith the second annual report of its activities and proceedings beginning July 1, 1928, and ending June 30, 1929.

In making our report, it has been divided into what might be termed three sections; the first section consisting of a complete detailed monthly report of the income of the Board; the second giving a detailed report of the expenditures; the third being a summary of what was accomplished in a general way, including shops inspected, certificates revoked, warrants for arrest issued, etc.

We are proud of the cooperation given us by the public and the barbers of California. You will note that 1681 complaints came in to us from the public during the year. We believe that the cooperation we have had from the Japanese and Mexican barber associations, as well as that from the numerous other barber associations throughout the state, goes to show that the barbers, as well as the public, are well satisfied with the law.

The educational requirement of the law is an outstanding feature. We had forty-three Spanish-speaking barbers attending night school in Los Angeles in order to qualify for the educational requirement. Even after meeting those requirements, a number of them continued to attend night school, as they realized keenly the advantage of being capable of speaking the English language fluently.

We have thirty-eight deputies throughout the state who conduct our educational examinations and handle application blanks. Barbers are thus enabled to meet the requirements without a great deal of delay as was experienced before the deputies were appointed.

We feel deeply indebted to the various state departments for the splendid assistance and cooperation given us during the past year.

The monthly detailed report of income receipts from July 1, 1928, to June 30, 1929:

1928			
JULY:			
Journeyman examination with permit	110 @	$10 00	$1,100 00
Journeyman examination without permit	33 @	10 00	330 00
Barbers' license, 1928	28 @	2 00	56 00
Barbers' license, 1929	8,197 @	2 00	16,394 00
Apprentice license, 1929	11 @	1 00	11 00
Apprentice license, 1929, renewal	143 @	1 50	214 50
Educational test	17 @	3 00	51 00
Apprentice examinations	18 @	5 00	90 00
Total			$18,246 50
AUGUST:			
Journeyman examination with permit	106 @	$10 00	$1,060 00
Journeyman examination without permit	82 @	10 00	820 00
Barbers' license, 1928	13 @	2 00	26 00
Barbers' license, 1929	7,280 @	2 00	14,560 00
Apprentice license, 1929	29 @	1 00	29 00
Apprentice license renewal	173 @	1 50	259 50
Educational test	156 @	3 00	468 00
Apprentice examination	37 @	5 00	185 00
Total			$17,407 50
SEPTEMBER:			
Journeyman examination with permit	80 @	$10 00	$800 00
Journeyman examination without permit	27 @	10 00	270 00
Barbers' license, 1928	4 @	2 00	8 00
Barbers' license, 1929	320 @	2 00	640 00
Barbers' license, 1929, penalty attached	293 @	5 00	1,465 00
Apprentice license	17 @	1 00	17 00
Apprentice license renewal	2 @	1 50	3 00
Apprentice license, renewal, penalty attached	4 @	3 00	12 00
Educational test	139 @	3 00	417 00
Apprentice examination	17 @	5 00	85 00
Examination—extra	1 @	1 00	1 00
Total			$3,718 00
OCTOBER:			
Journeyman examination with permit	143 @	$10 00	$1,430 00
Journeyman examination without permit	35 @	10 00	350 00
Barbers' license, 1928	6 @	2 00	12 00
Barbers' license, 1929	61 @	2 00	122 00
Barbers' license, 1929, penalty attached	233 @	5 00	1,165 00
Apprentice license, 1929	5 @	1 00	5 00
Apprentice renewal, penalty attached	5 @	3 00	15 00
Educational test	132 @	3 00	396 00
Apprentice examination	9 @	5 00	45 00
Total			$3,540 00
NOVEMBER:			
Journeyman examination with permit	116 @	$10 00	$1,160 00
Journeyman examination without permit	61 @	10 00	610 00
Barbers' license, 1928	3 @	2 00	6 00
Barbers' license, 1929	215 @	2 00	430 00
Barbers' license, 1929, penalty attached	135 @	5 00	675 00
Apprentice license	24 @	1 00	24 00
Apprentice license, penalty attached	7 @	3 00	21 00
Educational test	168 @	3 00	504 00
Apprentice examination	34 @	5 00	170 00
Total			$3,600 00
DECEMBER:			
Journeyman examination with permit	99 @	$10 00	$990 00
Journeyman examination without permit	20 @	10 00	200 00
Barber license, 1928	3 @	2 00	6 00
Barbers' license, 1929	135 @	2 00	270 00
Berbers' license, 1929, penalty attached	94 @	5 00	470 00
Apprentice license	18 @	1 00	18 00
Apprentice license, renewal, penalty attached	4 @	3 00	12 00
Educational test	91 @	3 00	273 00
Apprentice examinations	16 @	5 00	80 00
Total			$2,319 00

1929

JANUARY:			
Journeyman examination with permit	88 @	$10 00	$880 00
Journeyman examination without permit	44 @	10 00	440 00
Barbers' license, 1929	47 @	2 00	94 00
Barbers' license, 1929, penalty attached	73 @	5 00	365 00
Apprentice license	10 @	1 00	10 00
Apprentice license, renewal, penalty attached	3 @	3 00	9 00
Educational test	89 @	3 00	267 00
Apprentice examination	15 @	5 00	75 00
Total			$2,140 00
FEBRUARY:			
Journeyman examination with permit	66 @	$10 00	$660 00
Journeyman examination without permit	83 @	10 00	830 00
Barbers' license, 1929	189 @	2 00	378 00
Barbers' license, 1929, penalty attached	35 @	5 00	175 00
Apprentice license	34 @	1 00	34 00
Educational test	85 @	3 00	255 00
Apprentice examination	41 @	5 00	205 00
Total			$2,537 00
MARCH:			
Journeyman examination with permit	59 @	$10 00	$590 00
Journeyman examination without permit	9 @	10 00	90 00
Barbers' license, 1928	1 @	2 00	2 00
Barbers' license, 1929	22 @	2 00	44 00
Barbers' license, 1929, penalty attached	32 @	5 00	160 00
Apprentice certificate	6 @	1 00	6 00
Educational test	93 @	3 00	279 00
Apprentice examination	4 @	5 00	20 00
Total			$1,191 00
APRIL:			
Journeyman examination with permit	57 @	10 00	$570 00
Journeyman examination without permit	34 @	10 00	340 00
Barbers' license, 1929	28 @	2 00	56 00
Barbers' license, 1929, penalty attached	31 @	5 00	155 00
Apprentice license	13 @	1 00	13 00
Apprentice license, renewal, penalty attached	2 @	3 00	6 00
Educational test	76 @	3 00	228 00
Apprentice examination	15 @	5 00	75 00
Total			$1,443 00
MAY:			
Journeyman examination with permit	65 @	$10 00	$650 00
Journeyman examination without permit	77 @	10 00	770 00
Barbers' license, 1928	1 @	2 00	2 00
Barbers' license, 1929	188 @	2 00	376 00
Barbers' license, 1929, penalty attached	17 @	5 00	85 00
Apprentice license	44 @	1 00	44 00
Apprentice license, renewal, penalty attached	2 @	3 00	6 00
Educational test	89 @	3 00	267 00
Apprentice examination	46 @	5 00	230 00
Total			$2,430 00
JUNE:			
Journeyman examination with permit	73 @	$10 00	$730 00
Journeyman examination without permit	10 @	10 00	100 00
Barbers' license, 1929	10 @	2 00	20 00
Barbers' license, 1929, penalty attached	17 @	5 00	85 00
Apprentice license, renewal, penalty attached	1 @	3 00	3 00
Apprentice examination	3 @	5 00	15 00
Educational test	93 @	3 00	279 00
Total			$1,232 00
Total for year			$59,804 00
Prior year income			29 00
Total			$59,833 00

STATEMENT OF INCOME

July 1, 1928 to June 30, 1929, Inclusive

Journeyman examination with permit	1,062 @	$10 00	$10,620 00
Barbers' license, 1928	59 @	2 00	118 00
Prior year license			29 00
Barbers' license, 1929	16,692 @	2 00	33,384 00
Barbers' license, 1929, penalty attached	960 @	5 00	4,800 00
Educational test	1,228 @	3 00	3,684 00
Journeyman examination without permit	515 @	10 00	5,150 00
Apprentice certificates	211 @	1 00	211 00
Apprentice license, renewal	318 @	1 50	477 00
Apprentice license, renewal, penalty attached	28 @	3 00	84 00
Apprentice examination	255 @	5 00	1,275 00
Fee collected for superfluous examination			1 00
Total			$59,833 00

DETAIL OF EXPENDITURES

	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Subtotal	Gross total
July, 1928—						
Administration	$102 94	$1,404 00	$213 57	$7 38	$1,727 89	
Investigation		300 00	688 10		988 10	
Examination			126 45		126 45	
Prior year expense:						
Administration	41 31		15 83		57 14	
Investigation			5 69		5 69	
Examination			2 50		2 50	
						$2,907 77
August, 1928—						
Administration		$1,582 50	$244 90		$1,827 40	
Investigation		300 00	492 29		792 40	
Examination			700 81		700 81	
						3,320 50
September, 1928—						
Administration	$301 89	$1,488 00	$80 06	$8 40	$1,878 35	
Investigation		300 00	509 90		809 90	
Examination			232 65		232 65	
						2,920 90
October, 1928—						
Administration		$1,437 00			$1,437 00	
Investigation		440 32			440 32	
Examination						
(Expenses in November expenditures)						1,877 32
November, 1928—						
Administration	$19 29	$1,428 00	$454 36	$13 12	$1,914 77	
Investigation		600 00	712 58		1,312 58	
Examination			150 78		150 78	
						1,378 13
December, 1928—						
Administration	$209 26	$1,432 50	$179 50	$7 00	$1,828 26	
Investigation		600 00	1,480 41		2,080 41	
Examination			827 13		827 13	
						4,735 80
January, 1929—						
Administration	$11 00	$1,437 00	$89 82		$1,537 82	
Investigation		620 00	795 39		1,415 39	
Examination			192 91		192 91	
						3,146 12
February, 1929—						
Administration	$47 22	$1,425 00	$55 34	$61 80	$1,589 36	
Investigation		620 00	793 18		1,413 18	
Examination			548 10		548 10	
						3,550 64
March, 1929—						
Administration	$63 81	$1,435 50	$48 00	$57 39	$1,604 70	
Investigation		620 00	593 58		1,213 58	
Examination			80 06		80 06	
						2,898 34
April, 1929—						
Administration	$6 32	$1,437 00	$99 85		$1,543 17	
Investigation		820 00	902 62		1,722 62	
Examination			231 90		231 90	
						3,497 69
May, 1929—						
Administration	$8 14	$1,437 00	$73 10		$1,518 24	
Investigation		820 00	732 77		1,552 77	
Examination			619 47		619 47	
						3,690 48
June, 1929—						
Administration	$78 05	$1,432 50	$50 55	$25 35	$1,593 45	
Investigation		820 00	1,043 14		1,863 14	
Examination			115 00		115 00	
						3,571 59
Grand totals	$887 23	$24,236 32	$14,191 29	$180 44		$39,495 28

STATEMENT OF EXPENDITURES

Function	July 1, 1928 to June 30, 1929, inclusive				
	Material and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration—					
Board members		$10,800 00	$393 38		$11,193 38
Clerical and office	$138 43	5,580 00	40 10	$180 44	5,938 97
Postage			834 97		834 97
Printing	707 49				707 49
Extra help		996 00			996 00
Janitor service			85 69		85 69
Telephone and telegraph			243 91		243 91
Prior year expense	41 31		15 83		57 14
Totals	$887 23	$17,376 00	$1,613 88	$180 44	$20,057 55
Examinations—					
Traveling expenses			$1,181 81		$1,181 81
Rent and educational tests			2,643 45		2,643 45
Prior year			2 50		2 50
Totals			$3,827 76		$3,827 76
Investigations—					
Board members			$4,656 26		$4,656 26
Inspectors		$6,860 32	4,087 70		10,948 02
Prior year			5 69		5 69
Totals		$6,860 32	$8,749 65		$15,609 97
Grand total					$39,495 28

GENERAL SUMMARY OF WHAT HAS BEEN ACCOMPLISHED FROM JULY 1, 1928 TO JUNE 30, 1929

Shops inspected	16,516
Barbers inspected	30,360
Barbers without certificates	158
Barbers working on expired certificates	172
Barbers working on expired permits	44
Shops closed	123
Partitions ordered up	270
Complaints received and checked	1,681
Warrants for arrest	57
Convictions	51
Certificates revoked	57
Barber schools closed	2
Failed to renew license	1,229
Barbers who failed to pass second examination	597
Apprentices who failed to pass examination	77

You will note that we found 158 barbers working without certificates. Fifty-seven of them were arrested, out of which, fifty-one were convicted. Two of the cases were thrown out of court on account of insufficient evidence, and the remaining four cases have not yet come up. No arrests were made except in cases where parties refused to comply with the requirements of the law.

We held examinations in the following cities once every three months with the exception of Ukiah, Eureka, and Redding, where examinations were held only once every six months:

Sacramento	93	San Luis Obispo	24
Stockton	52	San Jose	68
Fresno	75	San Francisco	208
East Bakersfield	38	Oakland	133
San Diego	86	Ukiah	5
El Centro	31	Eureka	9
San Bernardino	60	Redding	16
Los Angeles	1,038		
Santa Barbara	38	Total	2,034

This totals 2034 barbers who came before this board for examination.

BARBERS WORKING IN CALIFORNIA AS OF JUNE 30, 1929

Registered barbers	17,652
Registered apprentices	557
Barbers working on permits	250
Total	18,459

All of which is respectfully submitted.

STATE BOARD OF BARBER EXAMINERS
OF CALIFORNIA

J. T. Haywood, President
C. L. Butts, Director of Examinations
C. E. Rynearson, Secretary

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70119 8-29 1150

Investigation and Report on Toll Bridges in the State of California

CALIFORNIA HIGHWAY COMMISSION



64951

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To the Honorable Members of the
State Legislature of California,
Session of 1929.

Pursuant to the provisions of an act of the legislature approved May 19, 1927 (chapter 636, Statutes 1927), which provides for an investigation by the California Highway Commission of the operation of toll bridges in California, and authorizes and empowers this commission to make a report thereon with recommendations, we have the honor to transmit to you the results of such study in the accompanying report.

Respectfully submitted.

CALIFORNIA HIGHWAY COMMISSION,

RALPH W. BULL, *Chairman,*
J. P. BAUMGARTNER,
M. B. HARRIS,
F. S. MOODY,
JOSEPH M. SCHENCK,
Members.

Sacramento, January 23, 1929.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
SACRAMENTO

January 18, 1929.

To the Members of the California Highway Commission,
Sacramento, California.

GENTLEMEN:

I am herewith transmitting the report of the Division of Highways, upon its investigation of the construction and operation of toll bridges in California. This investigation was authorized and directed by the legislature of 1927.

The facts and findings in this report indicate the need for legislation to remedy the situation.

Sincerely yours,

(Signed) B. B. MEEK.

MR. B. B. MEEK, *Director*,
Department of Public Works,
Sacramento, California.

DEAR SIR:

We herewith submit a report on toll bridges in the State of California.

The subject matter of this report has been compiled by the Bridge Department of the Division of Highways under the direction of C. E. Andrew, bridge engineer.

This report is in compliance with a law passed by the state legislature of 1927.

Very truly yours,

C. H. PURCELL,
State Highway Engineer.

INVESTIGATION AND REPORT ON TOLL BRIDGES IN THE STATE OF CALIFORNIA

SECTION I.

PURPOSE OF THE REPORT AND INTRODUCTION

1. PURPOSE OF THE REPORT.

The following report to the forty-eighth session of the Legislature is made in compliance with chapter 636 of the Statutes of 1927. The title of the act is "Investigation of Toll Bridges" and reads as follows:

INVESTIGATION OF TOLL BRIDGES.

Act providing for an investigation by the California Highway Commission of the operation of toll bridges in California and for the submission of a report thereon with recommendations to the forty-eighth session of the Legislature.

(New legislation, Statutes 1927, chapter 636.)

Section 1. *Investigation of toll bridges by Highway Commission. Report to Legislature with recommendations.* The California Highway Commission shall investigate any existing or contemplated toll bridges operated as connecting links of the state highway system and shall make a report to the Legislature at the forty-eighth session embodying recommendations with reference to taking over any or all existing privately owned or operated toll bridges by the State of California, with a plan for financing the acquisition of same and amortization of the cost of such acquisition by tolls; such bridge or bridges then to be free of tolls and be made a part of the state highway system; or make recommendations as to the construction of bridges, and any pertinent matter relating to the problem.

Sec. 2. *Authority to employ assistance. May summon witnesses, etc.* The said commision is hereby authorized and empowered to do any and all things necessary to make a full and complete investigation of the matters and subject hereinbefore enumerated or recited, and to that end may employ all necessary clerical and legal assistance, and the said commission is hereby authorized and empowered to summon witnesses, require the production of persons, books, accounts, agreements, documents, records and papers of every kind, to issue subpoenas, and to take all necessary means to compel the attendance of witnesses and procure testimony; and the members of said commission are, and each of them is hereby empowered to administer oaths. Subpoenas and all orders or other processes which may be issued by the commission may be served by any peace officer of the state.

Sec. 3. *Expenditures to be made from current appropriations.* All expenditures by the commission in carrying out the purposes of this act shall be paid out of the appropriations or funds available for the support of the California Highway Commission upon claims presented and signed by the chairman of the commission in accordance with law, but all such expenditures of the commission shall not exceed the sum of five thousand dollars.

An investigation of all the existing toll bridges in the State of California, which are now in operation or will soon be put in operation, as well as contemplated toll bridges, has been made and the following report is the result of these investigations. The purposes of the report are those outlined and defined in the act, which are, to present to your honorable body in a concise manner all the facts pertaining to the inaugurating, organizing, financing, designing, constructing and operating of each toll bridge, and further, to ascertain the value of each toll bridge to the traveling public with respect to its location, necessity and monetary value; to recommend as to the advisability of acquiring any or all of these toll bridges by the State of California; to determine the amounts of funds required for such acquisition and to recommend ways and means of raising the said funds.

2. INTRODUCTION.

a. *Toll bridges in operation or under construction.*—There are now in operation within or on the boundaries of the state, seven privately owned toll bridges, which are:

Three bridges owned and operated by the Sears Point Toll Road Company, as a part of their toll road between Vallejo and Sears Point. One bridge is over the Napa River in Solano County, one over Sonoma Creek on the boundary between Solano and Sonoma counties and one over Tolay Creek in Sonoma County. They may be referred to as "Sears Point cut-off bridges."

Two bridges owned and operated by the American Toll Bridge Company. One bridge is over Carquinez Strait near Crockett between Contra Costa and Solano counties, generally referred to as the "Carquinez Bridge" and another bridge over the San Joaquin River near Antioch between Contra Costa and Sacramento counties, generally known as the "Antioch Bridge."

A bridge owned and operated by the Dumbarton Bridge Company, crossing the southerly arm of San Francisco Bay between the vicinity of Redwood City, in San Mateo County on the westerly side and Niles on the easterly, or Alameda County, side. It is known as the "Dumbarton Bridge."

A bridge owned and operated by the California-Arizona Bridge Company, crossing the Colorado River at Ehrenburg, Arizona, about 3½ miles east of Blythe in Riverside County. It is herein referred to as the "Ehrenburg Bridge."

There is also one privately owned toll bridge in the state under construction at the time of writing this report, it is:

A bridge owned and to be operated by the San Francisco Bay Toll Bridge Company, crossing the bay between San Mateo in San Mateo County and the vicinity of Hayward in Alameda County. It is to be known as the "San Mateo-Hayward Bridge." It is expected that this bridge will be opened to traffic early in the spring of 1929.

b. *Franchises granted or applied for.*—There are now two franchises for proposed toll bridges held by private interests, they are:

A franchise granted by Contra Costa County and now assigned to O. H. Klatt, for a bridge across San Pablo Bay from a point near Richmond in Contra Costa County to a point near San Rafael in Marin County.

A franchise granted by Alameda County to T. A. Tomasini for a bridge crossing upper San Francisco Bay from a point opposite Albany in Alameda County to a point near Tiburon in Marin County.

There have been a large number of franchises sought by different parties to bridge the waters of the San Francisco Bay district, all of which have been denied by the supervisors of the county having jurisdiction, they are:

Applications for franchises to construct bridges across San Francisco Bay from the municipal district of San Francisco to that of the east bay cities. Some 33 applications have been made to San Francisco County, two to Alameda County and four to San Mateo County for such franchise. The city of San Francisco has applied to congress for a permit to build a bridge across the bay at the location proposed by its board of engineers in their report dated May, 1927.

Applications for franchises to construct bridges across the Golden Gate. One application for a tunnel was made to San Francisco County

and a road district including all or portions of the north coast counties is being formed for the purpose of constructing a bridge.

Applications for other bridges to cross Carquinez Strait. Three such applications have been made to the supervisors of Contra Costa County.

There has been an effort made for some time to build a toll bridge crossing San Diego Bay between San Diego and Coronado but up to date the proposed plans have not met with the approval of the War and Navy Departments. At the present time this bridge is in no way to be considered a connecting link of the state highway system.

e. *There follows a list of all the various bridges and applications* for toll bridges enumerated above with the name of the owning company, or applicant in the case of a franchise only, the status of the project and a reference number calling attention to the location on Plates 1, 1a and 1b which follow it.

INVESTIGATION OF TOLL BRIDGES

List of Toll Bridges, Constructed or Proposed, in the State of California

Plates 1, 1a, 1b,	Bridge crossing	Owning company or applicant	Status
1	Napa River	Sears Point Toll Road Company	Road in operation
2	Sonoma Creek	Sears Point Toll Road Company	Road in operation
3	Tolay Creek	Sears Point Toll Road Company	Road in operation
4	San Joaquin River near Antioch	American Toll Bridge Company	Bridge in operation
5	Carquinez Strait near Vallejo	American Toll Bridge Company	Bridge in operation
6	Other applications Carquinez Strait —		
	(a) Dillon Point to Eckley	Northern California Dev. Company	Application denied
	(b) Dillon Point to Eckley	San Francisco Transit Co. (2 applic.)	Application denied
	(c) Crockett to Dos Reis Ranch	Crockett Land and Cattle Company	Application denied
7	Richmond-San Rafael Route. San Francisco Bay-Point San Pablo to McNears Point	O. H. Klatt	Franchise granted. War Department hearing, January 3, 1929
8	Albany-Tiburon Route. San Francisco Bay-Point Felming to Bluff Point and across Richardson Bay	T. A. Tomasini	Franchise granted. Not yet approved by War Department
9	Golden Gate	One application for a tunnel. Application denied. Road district being formed for purpose of constructing bridge	
10	San Francisco Bay-San Francisco County to Alameda County	23 different parties made a total of 33 applications for bridges and tunnels crossing between Hunters Point and Telegraph Hill in San Francisco. 2 applications made to Alameda County as having jurisdiction	All applications denied
		Bill presented to Congress by City of San Francisco for permission to construct bridge on location proposed by Board of Engineers	Hearings held before committee. No action taken
11	San Francisco Bay San Mateo County to Alameda:		
	Little Candle Stick Point to Bay Farm Island	Frank E. Webb, C. J. Carey	All applications denied
	Little Candle Stick Point to Foot of Webster Street, Alameda	Robert W. Thompson, Albert Mansfield	
12	San Francisco Bay—San Mateo to Hayward	San Francisco Bay Toll Bridge Company	Bridge nearing completion
13	San Francisco Bay—Dumbarton Crossing	Dumbarton Bridge Company	Bridge in operation
14	Colorado River near Blythe, California-Arizona Line	California-Arizona Bridge Company	Bridge completed. Pier washed out, repairs under way
15	San Diego Bay- San Diego-Coronado	John L. Harrington, California Bridge and Tunnel Company	Application to War Department not yet approved


S.H. Rte #2
S.H. Rte #39
S.H. Rte #38
S.H. Rte #2
S.H. Rte #39
S.H. Rte #31
S.H. Rte #2
S.H. Rte #39
S.H. Rte #31
S.H. Rte #58
S.H. Rte #64
S.H. Rte #62
S.H. Rte #23
S.H. Rte #26
S.H. Rte #78
S.H. Rte #27
MOJAVE
BARSTOW
LOS ANGELES
SAN BERNARDINO
NEEDLES
TOPOCK
MECCA
BLYTHE
EHRENBURG
SAN DIEGO
EL CENTRO
YUMA
PACIFIC OCEAN
To Salt Lake
U.S. Rte #91
UTAH
Free Bridge
Colorado River
Toll Bridge
ASH FORK
MAINE
GRAND CANYON
FLAGSTAFF
U.S. Rte #66
To Santa Fe N.M. and Chicago Ill.
U.S. Rte #70
To Wichita Falls Tex. and Beaufort N.C.
WICKENBURG
PHOENIX
NEW MEXICO
HASSAYAMPA
U.S. Rte #80
Free Bridge
ARIZONA
MEXICO
TUCSON
To El Paso Tex. and Atlanta Ga.
U.S. Rte #80
Plate I.b
INVESTIGATION OF TOLL BRIDGES
MAP SHOWING EXISTING COLORADO RIVER BRIDGES ON STATE HIGHWAYS OF CALIFORNIA AND CONNECTIONS WITH U.S. ROUTES IN ARIZONA.
LEGEND
CALIFORNIA HIGHWAY ROUTES
ALL OTHER ROADS.

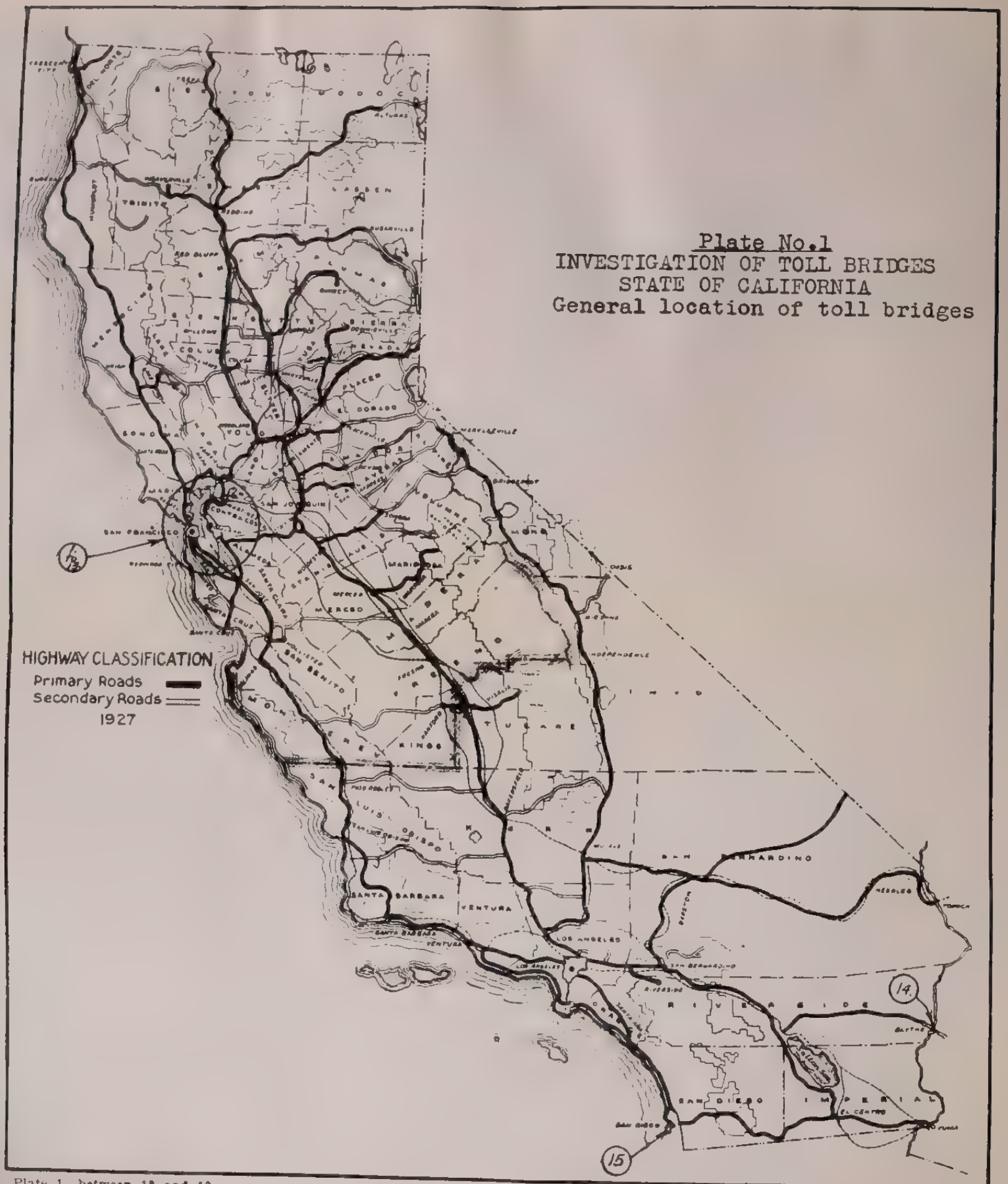


Plate 1—between 12 and 13.



Plate 1a—between 12 and 13.

d. *General survey of toll bridge situation.*—A general survey of the situation shows that with the exception of the existing toll bridge over the Colorado River, all existing toll bridges, or locations where toll bridges have or are being considered, occur in the vicinity of San Francisco Bay. It also shows that existing or proposed toll bridges are at the present time connecting links of the state highway system, although in some instances several miles of county road or city streets must be traveled in order to reach one or both ends of each bridge. It is advisable to make a study of the relation of each existing and proposed toll bridge project to the highway system as it exists, together with such economically reasonable improvements or reroutings as may apply to the situation. Section IV of the report is devoted to this phase of the situation and covers the routing, mileage, condition and traffic on state and county highways which connect centers of population, or are through traffic routes, and which, in any way, relate to existing or proposed toll bridge projects.

It is found that the laws relating to the right to operate toll bridges and the granting of franchises therefor, date back to the Political Code (1872) and Statutes of 1881 relating to bridges over navigable streams. No amendments have since been made which change the principle of application of these laws which are based upon the idea of delegating these rights to the counties, and therefore are found to be more or less incompatible with the existing idea of a state highway system. Section III of the report is devoted to a statement of the existing laws on the subject and shows their relation to the construction and operation of a toll bridge as part of a state highway route.

Since the law states that recommendations shall be made with reference to taking over any or all existing toll bridges by the state, it becomes necessary to gather all possible data relative to their organization, construction and operation. Therefore, under Section V of the report there is included for each individual project, the following information:

General description of the project
Organization
Financing
Preliminary investigation and design
Construction data
Traffic and income
Operation and maintenance
Interest and amortization
Present value of the project

Under section V there is discussed the possible methods by which the state may acquire a toll bridge project and operate it as such or by which it may construct a bridge and pay for its construction. It involves the raising of funds to pay the cost of construction by state or district bonds, or financing through revenue bonds and amortizing the first cost through the collection of tolls or other means.

SECTION II.

SUMMARY AND CONCLUSIONS

Summary and conclusions as follows are drawn from an investigation and study of the toll bridges covered in this report.

1. Pertaining to matters of promotion and organization of both privately and publicly owned toll bridges.

a. It is shown that the cost of promotion and organization of privately owned toll bridges is in many cases a major item in the cost. Such an expense does not amount to any considerable sum in the cost of a publicly owned and constructed bridge. For this purpose $1,166,776 was spent on the Carquinez and Antioch bridges. The estimated organization cost connected with building these bridges under state supervision, publicly financed, is $153,500.

The cost of promotion and organization for the San Mateo-Hayward Bridge is difficult to segregate. An item of $154,060 is given in their original cost estimate for organization, legal and corporation expenses. It is noted under construction data that 5567 shares of preferred stock and 22,268 shares of common stock were given the Raymond Concrete Pile Company for promotion and organization. The preferred stock is valued at $55,670, and the common stock has been shown to have an estimated value of from $33 to $79.50 per share depending on the interest rate and future traffic.

These figures indicate at least $55,670 plus $730,000, or $785,670, may be charged to promotion and organization. It is estimated that a similar charge under state construction would not exceed $160,000.

b. The conclusion is drawn that private interests are inclined to recognize the necessity of bridges at strategic points more readily than are public officials. Likewise, private interests and promoters often build or attempt to build toll bridges at locations where the traffic does not justify them. Anticipated profits from one or more of the following sources are the inspiration for toll bridge promotion, namely: promotion fees, bridge contracts and profits from tolls based on expected future traffic.

c. The conclusion is drawn that in the case of the Carquinez Bridge, public officials failed to recognize the necessity of building a publicly owned structure.

d. It is also evident from the estimated tolls which could have been charged, had the state financed the San Mateo-Hayward Bridge, that the cost of service over the remaining 47-year life period of the franchise would, on a publicly owned bridge at this location, be only about 35 per cent of that which will be charged by the privately owned toll bridge, provided the now authorized rates of tolls are maintained until such time as the 15 per cent earning as limited by law compels their reduction.

2. Pertaining to matters of financing.

a. The cost of financing privately owned toll bridges is higher than the cost of financing publicly owned toll bridges. It is shown that the cost of financing the Carquinez and Antioch bridges includes an item

of 500,000 shares stock bonus and an item of $673,853 for bond discount. Computing the stock at par value $1 per share, gives a sum of $1,173,853 discount on a $6,500,000 bond issue. $4,500,000 of these bonds bear 7 per cent interest and $2,000,000 bear 8 per cent interest.

Bonds issued by the State of California guaranteed by the credit of the state and bearing 4½ per cent, can be sold by the state at par.

Income bonds bearing 6 per cent interest issued by the state but having only the income from tolls as the sole security, can be sold at par.

b. Financing a privately owned toll bridge by sale of stock is usually difficult and is extended over a comparatively long period of time. As a result a considerable part of the franchise life is consumed before construction can be financed. The result is that income bearing time is lost and the cost of service to the public raised.

The cost of selling stock is high. The usual commission for selling this class of stock is 20 per cent.

c. The conclusion is drawn that no corporation is more able to finance necessary bridges connecting with the state highway system than the State of California. Nor can any private corporation finance bridges as cheaply as can the state.

d. The state can most economically finance toll bridges by issuing bonds which are recognized as a direct obligation on the state, but which are to be retired by income from tolls. Such bonds would require a vote of the people for each bridge project.

Since such a method of financing is not generally practicable, the best alternate method of financing is to issue income bonds which have as their sole security the income from tolls. The state can sell such bonds at a much lower rate of interest than can a private company, primarily because they are a safer investment. A private corporation has a certain time, limited by the franchise, in which to retire their bonds and amortize the cost of the bridge. The investor is required to gamble that sufficient income will be obtained in that limited period of time to pay interest and retire the bonds. As a result he demands a high rate of interest and a substantial bond discount.

The state in selling income bonds will fix a date at which the bonds are due, but if the income is not sufficient during that time to pay bond amortization and interest they can refinance the unpaid bonds and continue to collect tolls until the bonds are paid because they still own the bridge. This the private company cannot do because they must surrender the right to collect tolls at the expiration of the franchise. This is the major reason why investors demand a higher return on the bonds of privately owned bridges than they do on the bonds of ones publicly owned.

Referring to Section V, paragraph 4b, p. 50, of this report, it is shown that the annual cost of bond financing, including bond discount, stock bonus and interest is 8.7 per cent plus for the Carquinez and Antioch bridges. The state can sell income bonds at an interest rate of 6 per cent or less.

Referring to Section V, paragraph 4b, p. 85, San Mateo-Hayward Bridge, it is shown that the interest rate on bond financing including all charges is 7.7 per cent and to the same section, p. 95, for the Dumbarton Bridge, that the interest rate on bonds including all charges is 7.3 per cent.

3. Matters pertaining to income to investors in privately owned toll bridges.

a. It is shown that investors in the stocks of privately owned toll bridges in the State of California, in some cases may expect a fair return on their investment, in others a large return, and in others a low return. The stock return depends entirely upon the traffic realized. The predicted traffic charts and figures shown in this report are considered to be conservative and an increase or decrease is entirely possible.

No attempt has been made to estimate the effect of future competitive routes in estimating the traffic.

An average return on the par value of the stock *based on the predicted traffic* for the Carquinez and Antioch bridges is indicated at an approximate average of 6 per cent. An increase or decrease in the rate of growth of traffic will increase or decrease the rate of return to the stockholder.

It has been shown that the actual rate paid on money obtained through the issue of bonds is 8.7 per cent on the American Toll Bridge Company projects. An increase in traffic will slightly increase this return because of the stock bonus given the bonding company. This rate of return on bonds is considered to be excessive.

The report shows that, except for the possibility that a free bridge might have been constructed near Antioch, which would have detracted from the business of the Carquinez, the American Toll Bridge Company would have been better off as far as stock dividends are concerned if they had not built the Antioch Bridge.

b. In the case of the San Mateo-Hayward Bridge, it has been shown that the first mortgage bonds will return 6¼ per cent, and that the second mortgage bonds will return 10 per cent on the lowest predicted traffic estimate.

It has been shown that as far as we are able to ascertain, no actual money has been paid for any of the common stock. 120,000 shares have been issued and are held entirely by those directly interested in the bridge. It has been shown that on the lowest traffic estimate this stock will have a present worth of $33 per share with a reasonable possibility that it will be worth as much as $79.50 per share. This worth will be acquired by the common stock holders without capital investment (other than services prior to the opening of the bridge).

4. Matters pertaining to the traveling public.

a. The traveling public has received the added facilities of the Antioch and Carquinez bridges over those of a ferry at least five years in advance of the time when the state would have given them, due to the fact that public officials did not recognize the necessity of a publicly owned bridge at Carquinez.

b. It has been shown that the capital investment in the Carquinez and Antioch bridges is excessive when compared with the estimated cost of reproduction of these bridges by the state.

The costs are as follows:

Cost of construction of Antioch and Carquinez bridges to American Toll Bridge Company	$9,520,789
Estimated cost of construction to the state to reproduce these bridges at the same location financed by income bonds at 6 per cent	7,675,900

c. It has been shown that the cost of operation of the Carquinez and Antioch bridges is excessive when compared with the estimated cost of operation of similar bridges, had they been financed at a lower interest rate and constructed by the state.

The comparative costs of operation are as follows:

Combined annual cost of operation of Antioch and Carquinez bridges by the American Toll Bridge Company	$1,176,000
Combined annual estimated cost of operation by the state, of bridges constructed and operated by the state (6 per cent basis of financing)	918,600
Annual saving in cost of operation	$257,400

d. It has been shown that the average toll per vehicle, until 1948 when the bridges will become free, will be $0.82 for the Carquinez Bridge and $0.84 for the Antioch Bridge *as operated by the American Toll Bridge Company.* While the average toll necessary to operate and pay for a bridge similar to the Carquinez Bridge *if financed and built by the state* on a 6 per cent income bond basis would be $0.44 per vehicle, and if financed and built by the state on a 4½ per cent bond basis, the required toll would be $0.38 per vehicle.

It should be noted that an increase or decrease in traffic will not materially change the relative amount of tolls, as the toll rates under private or public ownership are in both cases a function of the traffic. An increase in traffic will justify the lowering of tolls in either case while a decrease in traffic will justify the raising of tolls.

For economic studies the above ratio between tolls on the privately owned bridges and the tolls on publicly owned bridges at Carquinez and Antioch, may be taken at the ratio of 83 to 44 or 38, depending on the method of financing the publicly owned bridges.

It would be difficult to lower the tolls on a privately owned bridge, even though the increase in traffic might justify such action, while on the publicly owned bridge no profits are expected and there would be no object in not lowering tolls if increased income justified such action.

The above ratio of tolls for the Carquinez and Antioch bridges indicates that for these bridges the cost of public service on the present bridges is at least 88 per cent higher than it would have been on similar bridges constructed and operated by the state.

It has been shown that the tolls permitted by law on the San Mateo-Hayward Bridge over the life of the franchise, viz, to 1977, will be as follows:

1930 to 1950:	
Pleasure cars	$0.60 per vehicle
Commercial cars	1.75 per vehicle
1950 to 1957:	
Pleasure cars	0.56 per vehicle
Commercial cars	1.66 per vehicle
1957 to 1977:	
Pleasure cars	0.56 per vehicle
Commercial cars	1.13 per vehicle

If the state had financed and constructed the bridge an average toll of 15 cents for pleasure cars and 58 cents for commercial vehicles would be all that is necessary to operate and amortize the cost of the structure over the active life of the franchise.

e. The conclusion is made that *any bridge*, be it a privately or publicly owned toll bridge or a publicly owned bridge on which no tolls have ever been paid, is a toll bridge. The traveling public eventually pays for all of them, either by tolls or taxes. A tax may be called a toll or a toll a tax, and the taxes or tolls paid constitute the cost of public service received in crossing the bridge. The method of building and financing any bridge which results in the least possible cost of public service is the best way.

A great many miles of highway and many bridges in the state would show an apparently high cost of public service on the capital invested if reduced to a toll basis, while the reverse would be true in many other cases. Likewise some of the privately owned roads and bridges show a relatively low cost of public service, and others show a high cost. In the case of privately owned bridges and roads, a relatively low cost of service will ordinarily represent a loss to the investors, while a relatively high cost of service will represent a profit to the investor.

The public should be supplied with necessary roads and bridges, but they should not be burdened with unnecessary ones.

All necessary roads and bridges should be either built and operated by the public or all built and operated by private capital. In either case, the cost of public service on all roads and bridges which show a high cost of operation should be offset by the low cost of service of roads and bridges which show a low cost of operation, if the public is to receive the minimum net cost of service over the entire system.

In the State of California either the state or counties and cities own and operate more than 95 per cent of the roads and bridges. It should, therefore, not be necessary nor should private capital be allowed to pick out advantageous points on the highway systems and build toll roads or bridges which will take profits that would otherwise tend to lower the average cost of highway service on the entire public highway system. Nor should private capital be required or allowed to select other points on the highway systems and build and operate roads and bridges, which will represent a loss to private investors even though such roads or bridges so operated may lower, or not increase the net cost of service over the entire highway system.

The economic construction and operation of the public highway system should be from a standpoint of the entire state, or even nation, rather than from a local point of view as a city or county. Many public officials are inclined to favor the building of toll roads and bridges by private capital, giving as reasons for so doing that they can not finance such roads and bridges, or that they expect to make money out of gross income tax or from tolls taken after the franchise expires and the bridge becomes local public property, or that no taxes or local bond issues will be necessary if financed by private capital.

Analyzing the problem of service cost the final conclusion is reached that the state can finance necessary roads and bridges at less cost than private corporations, that the paying of tolls is just as much a tax as is gas tax, or taxes levied to retire necessary bond issues; that the public will in most cases pay more in tolls to the private corporation than they would in tolls on a publicly owned toll road or bridge, or in taxes to retire necessary public bond issues, or in gas tax.

The argument that a county or city can make money from a toll bridge is fundamentally wrong. The citizens of any county or city eventually travel to a greater or lesser degree the roads of every other county or city. It is not economically sound that the citizens of one county or city should travel free the roads of any other county or city, or the state highway system, and in turn exact a profit from travelers outside of their boundaries using their roads and bridges.

The city and county of San Francisco has recognized these principles in rejecting all franchises applied for by private interests, to build a privately owned toll bridge across San Francisco Bay from San Francisco to Oakland or Alameda.

f. *Pertaining to present and added investments by the public in highway systems.*—A conclusion is drawn that the present enormous investment by the public in the state and county highways is being capitalized by private toll bridge companies. Added investments by the public as in the American Canyon, and roads south and north of San Francisco, tend to greatly increase the income of toll bridges.

5. Matters pertaining to existing and necessary laws governing the granting of franchises, construction and operation of privately owned toll bridges, the financing, purchase and operation of privately owned toll bridges by the state, and the financing, construction and operation of state owned toll bridges by the state.

a. A conclusion is drawn that existing laws governing the issuing of franchises for toll bridges, as well as their construction and operation, are obsolete and should be revised or amended in the following respects:

(1) The power of granting franchises to private corporations to build toll bridges on the state highway system, or on any county road that is, or may be, a connecting link of the highway system, should be vested in the Highway Commission or subject to their approval, and the rates of tolls fixed by the Railroad Commission.

(2) The law which is now in effect, giving the jurisdiction of granting franchises to the county situated on the left bank descending, is difficult of interpretation in the case of San Francisco Bay, and should be amended and clarified if the power of granting any franchises is to remain with the counties.

(3) Power should be given by law to the Highway Commission or Director of Public Works to locate, design, construct and operate toll bridges and to finance the location, design and construction of such bridges by issuing income bonds having as their sole security the income from tolls. The entire income from tolls, after deducting necessary operating costs, interest, current maintenance, and a reasonable sinking fund for maintenance after the tolls are removed, to be applied to the amortization of bonds. The bridge to be made a free bridge as soon as the bonds are paid.

(4) If the legislature has the power to do so, laws should be passed giving the Highway Commission or Director of Public Works authority to acquire existing privately owned toll bridges by purchase or by condemnation. Study of the subject brings out the fact that all existing toll bridges have been financed and constructed under franchises granted by counties under the stipulation that the power

to fix tolls and the right to purchase is vested in the counties. Whether or not this fixing of jurisdiction can be changed in the case of existing toll bridges is questionable because of the effect it might have on the property rights of the bridge companies.

6. Matters pertaining to the purchase by the state of existing toll bridges.

a. *Carquinez and Antioch bridges.*—If the state desires to purchase both or either of these bridges there are three methods of computing their value. These methods are developed in Section V of this report, and are arrived at from two points of view.

First—That of the stockholder of the American Toll Bridge Company. There are two values from the first viewpoint, viz, the cost of the bridges to the American Toll Bridge Company, and the estimated value of the stock from an investment point of view.

Second—Value of the bridges from the viewpoint of the traveling public.

The public has received an intangible value due to the added convenience of bridges over ferries. It is impossible to reduce this convenience to dollars and cents because it is not known how long it would have been after the present bridges were built until the public would have recognized the necessity and constructed similar bridges. This intangible value added to the sum it would have cost the state to build these bridges represents the true value to the traveling public.

Referring to Section V, it will be seen that the estimated values computed under these three headings are as follows:

(1) Cost of bridge as shown on the books of the American Toll Bridge Company	$9,520,789
(2) Value of the Carquinez Bridge as an investment	11,214,900
(3) Combined value of the Carquinez and Antioch bridges as an investment	11,846,400
(4) Value of the Carquinez Bridge to the public. Cost of reproduction by state. Not including intangible value	6,553,000
(5) Combined value of the Carquinez and Antioch bridges to the public, cost of reproduction by the state, not including intangible value	7,675,900

Either of values (4) or (5) can not now be realized by the public because privately owned bridges were allowed to be constructed rather than publicly owned ones.

Value (1) presumably represents the cost of the bridges to the bridge company. The problem of deciding between this value and value (3), or a compromise between the two, is either a matter of negotiation with the bridge company or a matter for the courts to decide. Values (2) and (3) are based on, a predicted future traffic and, a 6 per cent reinvestment basis for money received by the stockholders for the bridge. It is no doubt presumptious to predict traffic as far into the future as it is necessary to do in the case of any franchise and the reinvestment rate of interest is also a matter of judgment.

Whether an investment in the Carquinez Bridge involves sufficient risk to demand a 6, 7, 8 or 10 per cent interest, is purely a matter of opinion. If the stockholders' present investment in the bridge is safe enough to warrant only a 6 per cent return then he is entitled to a reinvestment rate of 6 per cent. On the other hand, if he has an 8 per

cent risk in the bridge, he is entitled to only a present worth based on an 8 per cent reinvestment which is much less than values (2) and (3).

Courts have, in determining similar values, taken into account all these factors but as far as it is possible to determine, no rule has been laid down and each case has been determined individually.

A study of these estimated values leads to the conclusion that it is almost impossible to fix an equitable purchase price for a privately owned toll bridge. If the lower value is fixed, the public obtains "value received" and the bridge company realizes a heavy loss, while on the other hand, if the higher value is fixed the bridge company obtains "value received" based on the original conception of its investment and the public pays $4,190,000, or approximately 60 per cent more for the bridges than if they had constructed and financed them themselves.

Referring to Section V, 11-c, it is seen that the state, if given the right by law, may purchase either or both the Carquinez and Antioch bridges, even at the cost of $11,214,900 for the Carquinez alone or $11,846,400 for both the Carquinez and Antioch bridges, and by refinancing them as outlined in Section V, 11-c, p. 74, greatly reduce the tolls now being charged by the American Toll Bridge Company. (Refer to tables in Section V 11-c.)

b. There are many difficulties to be surmounted and many steps to be taken before either the Carquinez or Antioch bridges, or for that matter any privately owned toll bridge, can be purchased by the state.

First—Laws must be amended or passed which will enable the state to do so.

Second—The state must decide which of the bridges or properties are to be purchased.

As has been explained, the American Toll Bridge Company has several properties among its assets, the principal ones being the Carquinez and Antioch bridges, the Martinez-Benicia ferry, the properties of the Rodeo-Vallejo ferry, and several parcels of land.

All of the values and estimates in this report pertaining to the American Toll Bridge Company are based on the assumption that only the bridge properties would be purchased, and that all other assets as ferries and real estate, except that occupied by bridges would remain as the property of the American Toll Bridge Company.

Third—If the Antioch bridge is to be acquired, it must be remembered that it is not now located on or within many miles of a state highway.

Fourth—The values given in this report are direct functions of what is a fair interest return, and of the correct prediction of future traffic.

Fifth—The present laws governing the acquisition of toll bridges gives the county granting the franchise the right to buy the bridge within five years from the filing of the certificate of completion of the bridge. If not purchased within this period, the right is then deferred until the bridge has been in existence for ten years or more.

Sixth—It will be necessary to change the law and, if possible, give the state the authority to purchase. This will probably require that the state make the present roads leading to the bridge or bridges state highways.

Seventh—The present law provides that the purchase price shall be determined by a board of arbitration, consisting of seven members,

three members to be appointed by the bridge company, three by the purchaser, and one by the judge of the superior court of the county.

San Mateo-Hayward Bridge.—If the state desires to acquire the San Mateo-Hayward Bridge, it will be required to recognize the clause in the franchise for the Dumbarton Bridge requiring that the county can not own or acquire any other bridge across the San Francisco Bay from San Mateo County without first buying the Dumbarton Bridge.

The estimated values for the San Mateo Bridge are as follows:

First. On a basis of cost to the bridge company	$7,500,000
Second. On a basis of reproduction cost by the state	5,946,000
Third. On an income value basis to the common stockholders (bridge company's traffic prediction)	
6% basis of reinvestment	17,677,270
8% basis of reinvestment	14,690,362

b. On an income value basis to the common stockholders (state traffic prediction)

6% basis of reinvestment	$14,457,490
8% basis of reinvestment	12,083,311

The great variation in these values indicates the extreme difficulty of determining what is a fair value for this or for that matter any of the other privately owned toll bridges. (Reader is referred to corresponding figures for other toll bridges given in this report.)

Summary of conclusions.

1. None of the existing toll bridges in the State of California are entirely on the state highway system.

The Carquinez Bridge, the San Mateo-Hayward Bridge and the Ehrenburg Bridge are important connections of the highway system.

2. Certain toll bridges have an intangible value in addition to their physical value, due to the fact that they have given the public the added advantage of a bridge over a ferry several years prior to the time the public officials realized their necessity as publicly owned bridges.

3. Privately owned toll bridges cost more than publicly owned bridges for the following principal reasons:

a. The cost of organization and promotion is more for the privately owned bridge than for the publicly owned one.

b. The cost of financing a privately owned toll bridge is higher than the financing of a publicly owned bridge.

c. The cost of construction of a privately owned toll bridge is somewhat higher (from 10 per cent to 25 per cent) than a publicly owned bridge, due in most cases to lack of competition in bidding on the contract.

d. The cost of operation is higher on a privately owned bridge than on a publicly owned bridge, primarily because amortization and interest charges are more.

4. The cost of public service over a privately owned toll bridge is higher than over a publicly owned one, because the capital investment is more and the interest rate higher. A profit is expected on a privately owned bridge and not on a publicly owned one.

5. The fixing of equitable values of privately owned bridges is so intricate and involved that it would seem almost impossible for the public to acquire them without either paying from 20 to as much as

250 per cent more than it would have cost the public to build them, or, on the other hand, causing a heavy loss to the investors in toll bridge stock.

6. The state or counties or cities own and operate more than 95 per cent of the highway and bridges in the state. If public ownership is proper for 95 per cent, it would seem proper on 100 per cent of the state system.

7. Added investment by the public in improving roads enhances the value of privately owned toll bridges located on or contiguous to these roads.

8. With possibly two exceptions, investors in the privately owned toll bridges in California will probably realize either fair or large returns on their investment.

9. If the state desires to acquire all of the privately owned toll bridges in California which are now or will be in operation during the year of 1929, there will be required the following approximate capital investments:

Based on the cost of the bridges to the toll bridge companies:

Carquinez and Antioch bridges	$9,520,800
San Mateo-Hayward Bridge	7,500,000
Dumbarton Bridge	2,121,000
Sears Point toll road and bridges	746,000
Ehrenburg Bridge	268,500
	$20,156,300

Based on the estimated present worth to stockholders.

Computed on state traffic prediction and 6 per cent reinvestment basis:

Carquinez and Antioch bridges	$11,846,400
San Mateo-Hayward Bridge	14,457,490
Sears Point toll road	1,250,000
Dumbarton Bridge	3,218,000
Ehrenburg Bridge	(none)

Examination of the report shows that the total estimated cost of reproduction of all of the above bridges by the state is about $16,225,000.

10. If the state can acquire the Carquinez and Antioch bridges even at the price of $11,846,400 and refinance them at 6 per cent, the tolls can be reduced from the present average toll of 82 cents per vehicle on the Carquinez and 84.2 cents per vehicle on the Antioch, to 52 cents and 61 cents respectively.

11. If the state can acquire the San Mateo-Hayward Bridge even at the figure of $14,457,490 and refinance it at 6 per cent, the average tolls can be very materially reduced below those which the bridge company have stipulated in the franchise.

Tolls are as follows:

	State Operated		Privately Owned	
Year	Auto	Truck	Auto	Truck
1930	$0.63	$1.90	$0.60	$1.75
1940	.46	1.40	.60	1.75
1950	.35	1.05	.60	1.75
1960	.29	.85	.38	1.13
1970	.24	.60	.38	1.13

12. All traffic predictions in this report which are a basis of computing present worth are of necessity based upon estimates. The general basis has been the natural increase in population expected without considering the effect of future competitive routes, etc. It is recognized that to predict traffic 50 years ahead is at best hazardous. In computing present worth, however, a considerable error in the more distant years has comparatively little effect on the present worth.

13. A study of the existing toll bridges, their cost of promoting, financing, construction and operation, should cause public officials having power to grant franchises to carefully analyze and study the economic questions involved before granting further franchises.

14. A general conclusion is drawn that, due to the exceeding difficulty in fixing a just value to both the public and private interests concerned, and due to the intricate legal phases involved, the only way for the state to acquire the ownership of existing toll bridges, if same is desired, is by condemnation.

15. A general conclusion is drawn that, due to the generally high cost of public service of privately owned toll bridges, and the extreme difficulty of acquiring them after they are constructed, at a value consistent with that for which the state or county could build and operate them, necessary steps should be taken to permit the state or counties to finance and build toll bridges on an income bond basis: *that the further construction of privately owned toll bridges should be prohibited.*

SECTION III

LAWS RELATING TO CONSTRUCTION AND OPERATION OF TOLL BRIDGES

(Note—No attempt will be made to set forth herein any exhaustive study of the legal status of toll bridges in California, but merely to indicate a few of the legal highlights and principles applicable to this subject.)

1. GRANTING OF FRANCHISES.

The granting of franchises is a sovereign prerogative and as such belongs to the Legislature. The Legislature in California has delegated this authority to the various boards of supervisors, by specific statutes. While it has been held that these boards are only agents of the Legislature, the grants so made are equally valid as if made by the Legislature.

Fall vs. *County of Sutter*, 21 Cal. 237 (1862).

a. Statutory powers of board of supervisors.

The boards of supervisors derive their power to grant franchises for toll bridge.

A. Entirely within boundaries of particular county from paragraphs 35 and 36 of section 4041 of the Political Code.

Paragraph 35 authorized toll franchises on roads, bridges, ferries, etc. (which are not already dedicated to the public).

Paragraph 36 provides for the granting of franchises on *public* roads and highways *only* whenever in their judgment the expense necessary to operate or maintain such roads or highways as free public highways is too great to justify the county in operating or maintaining them.

Even though bridges are not specifically mentioned in this paragraph, it has been held that bridges are highways and are therefore governed by this provision.

Sears vs. *Tuolumne County*, 132 Cal. 167 (1901).

B. Between two counties.

Section 2843 of the Political Code provides that in cases where bridge is across stream, etc., dividing two counties, the board of supervisors of the county on the left bank thereof shall have jurisdiction.

See Statutes 1881, page 76 (where bridge is across navigable stream), also section 2872 of the Political Code.

The granting of franchises in this case is predicated on compliance with the procedure and subject to conditions of other statutory provisions—especially the following sections of the Political Code:

2870, 2871, 2872, 2873, 2874, 2875, 2876, 2877, 2878, 2879, 2880, 2881.

C. Over navigable streams.

Statutes 1881, page 76, gives supervisors right to grant franchises for toll bridge across navigable streams, bays, etc.

This act is still in force.

Calvin vs. *Contra Costa*, 195 Cal. 686.

Chico Bridge Company vs. *Sacramento, etc.*, 123 Cal. 178 (1899).

See also section 2872 of Political Code validating franchises granted prior to 1881 act.

2. EXCLUSIVENESS OF FRANCHISE.

The common law rule that no rival toll bridge could be allowed so near to the ancient one to affect or take away its business (*Norris* vs. *Farmers, etc., Co.*, 6 Cal. 590) has been modified by section 2853 of the Political Code, providing that no toll bridge must be established within one mile above or below a regularly established toll bridge, *unless* the situation of some creek, the crossing of a public highway or the intersection of some creek or ravine renders it necessary for public convenience.

In determining public convenience the judgment of the board of supervisors is conclusive.

Waugh vs. *Chauncey*, 13 Cal. 11.

Poll vs. *Summons*, 134 Cal. 621, 625.

This section also applies to free bridges built by private individuals and corporations as well as to toll bridges.

Norris vs. *Farmers, etc., Co.*, 6 Cal. 590.

Unless the grant of franchise by its terms is exclusive, the legislature is not precluded from making other grants even though the second grant would tend to destroy the first grant.

Barham vs. *Turnpike Company*, 25 Cal. 283.

Fall vs. *County of Sutter*, 21 Cal. 237.

Charles River vs. *Warren Bridge Company* (U. S.) 11 Pet. U. S. 548; 9 L. Ed. 824.

3. EFFECT OF TERMINATION OF FRANCHISE.

It has been held that the construction of a toll bridge is a dedication of the bridge to public use, subject only to right to collect tolls. The bridge belongs to the public and the only interest of the holder of franchise is right to collect tolls as compensation for the building of the bridge.

Gardella vs. *Amador County*, 164 Cal. 555.

Section 2619 of the Political Code, provides that upon expiration of franchise by limitation or nonuser toll bridges shall become free public highways and no claim shall be valid against public for right of way, or for land or material comprising such bridge.

People vs. *Davidson*, 79 Cal. 166.

Sears vs. *Tuolumne County*, 132 Cal. 167, 172.

This section applies to inter- as well as intra-county bridges.

Gardella vs. *County of Amador* (supra).

4. TOLLS.

The collection of tolls under franchise is provided by section 2878 of the Political Code, specifying that boards of supervisors may fix tolls as they may from time to time prescribe, and paragraph 3 of section 2845 of the Political Code says—the tolls may raise annually an income not exceeding 15 per cent of the actual cost of the construction or erection of the bridge or ferry, and such additional income as will provide for the annual cost of operation, maintenance, amortization and taxes.

See also section 514 of Civil Code.

Section 528 of Civil Code.

Act March 14, 1881, Statutes 1881, page 76 (tolls for bridges over navigable streams).

Sections 2846, 2848 of Political Code.

5. PURCHASE OF TOLL BRIDGES.

Section 2881 of the Political Code provides that county or counties jointly acting in which same is situated may purchase a toll bridge, as provided for in sections 2801, and 2802 of the Political Code, regulating the purchase of toll roads.

SECTION IV

GENERAL STUDY OF HIGHWAY AND TRAFFIC CONDITIONS WITH RELATION TO TOLL BRIDGES

1. Introduction.

The state highway system is, presumably, a network of traffic arteries which best serves the county seats and important centers of population in the state and, at the same time, affords more or less direct routes connecting with all interstate highways. The existing highway system fulfills these requirements in a general way only and does not, for economic and political reasons, include all the heavy traffic roads nor all the most direct and suitable routes between important centers.

The kind or amount of traffic using a highway, whether "through" or "local," business or pleasure, passenger or freight, is not alone a criterion by which to judge its right to be included in the highway system. State highways are now being built or rebuilt to take care of local as well as long distance or interstate travel and for recreational purposes as well as for suburban conditions of heavy business and freight traffic.

None of the existing or projected toll bridges are actually on the state highway system but since some of these bridges carry a large highway traffic, it becomes necessary to consider the advisability of connecting them up with the state road system either by taking over existing county roads or by constructing new highway links.

This involves a study of the various factors which affect the choice of a highway routing. It is necessary that the proposed connection be one that does, or can be made to, provide proper standards of alignment, grade and width of road bed for present traffic which will permit of future improvement. The general route, of which the bridge and its connections are a part, must show advantages over alternate routes either on or off the state highway system. Factors to be considered are, its present condition, traffic carried and territory served as well as the possibilities for straightening, widening and general improvement of its service for traffic for present or possible future needs. Laws which definitely establish points on a state highway route must be considered and local conditions such as those which resist the removal of traffic from an established route cannot be overlooked.

2. General grouping of toll bridges and connecting highways.

As has been stated before, all existing and projected toll bridges, with the exception of the Ehrenburg Bridge, are located in the vicinity of San Francisco Bay. (The Ehrenburg Bridge over the Colorado River near Blythe, California, is a comparatively small structure, no larger than many already built from gas tax funds.)

For convenience of comparison and study of the factors mentioned above, all toll bridges in this vicinity may be grouped as follows:

a. Bridges across Carquinez Straits and the lower San Joaquin or Sacramento rivers, which bridges are on routes leading from the Bay district to the northern part of the state, and to the east via Sacra-

mento. In this connection it is necessary also to consider the alternate route through Marin County crossing the Golden Gate into San Francisco.

b. Bridges across upper San Francisco and San Pablo bays with the Napa River and Sonoma Creek sloughs to the north, connecting the territory east of the bay with Marin and lower Sonoma counties. These include the Sears Point toll road with its bridges over Napa River and Sonoma and Tolay creeks, together with the proposed bridges from Richmond to San Rafael and from Albany to lower Marin County.

c. Bridges crossing San Francisco Bay from the city and the Peninsula to various points on the east shore. These include the Dumbarton and San Mateo bridges, constructed and under construction, and require a consideration of the proposed location of a bridge between San Francisco and Oakland or Alameda.

In order to give a general idea of the present traffic situation in the vicinity of San Francisco Bay and for reference in the following discussions, a traffic chart has been prepared and is marked Plate No. II.

3. Carquinez Straits bridges and parallel crossings or routes.

a. Two separate main highways lead from Sacramento to the bay district connecting at Sacramento with the east and west side Pacific highways going north, and with the Victory and Lincoln highways going east. They are:

The Victory Highway route which follows the Sacramento River, crosses the Antioch bridge over the San Joaquin River and reaches Oakland via Concord, Walnut Creek and the tunnel road. Of the total length of 99.4 miles from Sacramento to Fourteenth and Broadway, Oakland, only 5.9 miles of road (just north of Rio Vista), is included in the present state highway system.

The present state highway via Davis, Dixon, Vacaville and Fairfield to Cordelia with a choice of two routes from Cordelia to the bay district. The first and heaviest traveled route from Cordelia is via Napa Junction and the Carquinez Bridge. The distance from Sacramento to Fourteenth and Broadway, Oakland, via this route is 96.0 miles, of which a distance of 11.2 miles (north of the Carquinez Bridge), is over county road.

The second route is via the Benicia-Martinez ferry and the Franklin Canyon county road, the latter being a shorter and quicker route than via the state highway. The distance via this route is 97.3 miles, of which distance 10.9 miles through the Franklin Canyon is a county road.

It is also possible to reach San Francisco through Marin County, either by branching off at Napa Junction and going via Napa and the Black Point cut-off or by branching off 5.8 miles south of Napa Junction and using the Sears Point toll road. The distance from Sacramento to the Sausalito ferry is 115.4 miles via Napa and the state highway, and 107.8 miles via the Sears Point road. Of the 107.8 miles, 5.8 miles is county and 12.2 miles is toll road and 89.8 miles is state highway.

Comparative mileages and estimated running time from Sacramento to terminals of ferries crossing the bay to San Francisco via most direct existing routes are:

	Distance in miles	Running time
Via Antioch toll bridge to Oakland ferry	103.0	3 hr. 25 min.
Via Carquinez toll bridge to Berkeley ferry	95.5	2 hr. 50 min.
Via Benicia ferry to Berkeley ferry	96.8*	3 hr. 20 min.
Via Sears Point toll road to Sausalito ferry	107.8	3 hr. 15 min.

These various routes and the mileages via each one are shown on Plate No. III.

b. *Highway connections and territory served.*—The Victory Highway route via the Antioch Bridge passes through the intensively developed farming districts along the Sacramento River and the delta country, is directly connected to roads which tap the industrial centers along the south side of Suisun Bay and which join the other two main highway routes, passes through the agricultural districts of Contra Costa and Alameda counties to the tunnel road into Oakland, and connects at Walnut Creek with a county highway leading directly to San Jose and the southerly coast points.

The route via the Benicia ferry connects the important centers of Davis, Dixon, Vacaville and Fairfield, and although leading directly to the east bay cities, serves, through alternate routes and direct connections, the same territory south of Suisun Bay as the Victory Highway.

The route via the Carquinez Bridge also connects directly with roads leading to the Napa and Sonoma valleys, Russian River points, Lake County and the Redwood Empire. It is, therefore, a central artery of traffic which is so situated that it connects with all important sectors in the most direct and practical manner, and still affords the fastest route for trunk highway traffic. The routing through Marin County to Sausalito is an alternate or branch highway for those whose destination is Marin County points, or who prefer to go directly into San Francisco, avoiding east bay suburban and urban traffic.

c. *Physical conditions and possible highway improvements.*—The Victory Highway route follows along the Sacramento River levee for a long distance, has considerable curvature in its alignment and requires careful driving in many places. It is paved throughout, the pavement being in generally fair condition. It could only be straightened and widened with difficulty and at great expense, owing to the cost of right of way, widening the levees and the numerous sloughs and river crossings. It can not be made to serve the northerly coast points as well as the highway via Fairfield does.

The state highway from Sacramento to Cordelia passes through a level country that, with the possible exception of crossing the Yolo basin, offers no obstacle to highway construction. The governing factors in relocating this highway would be the cost of right of way and local objection of property owners and small towns. The present road is well paved, has practically level grades and no dangerously sharp curves, but is indirect in routing even between adjacent towns. It is possible to save around 8 miles by building a direct highway from Sacramento to Cordelia, but less extensive realignments can be made along the present route at practically any point where justified from

*Does not include distance by ferry.

PLATE II—Traffic Chart San Francisco Bay Region. Opp. p. 30.

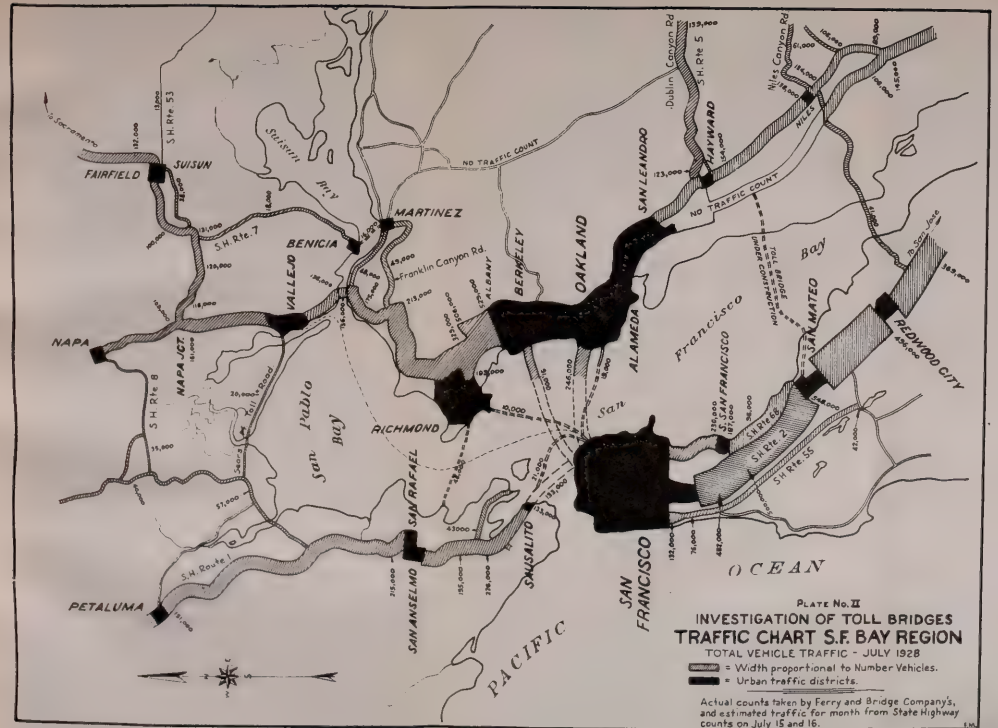


Plate II—between 30 and 31.

an economic standpoint. From Cordelia to the Carquinez Bridge a more direct route via what is known as American Canyon has been under consideration for some time. This connection would reduce the distance from Cordelia to the bridge by 5.6 miles, and the distance to Marin County via the Sears Point road by a slightly smaller amount. It is also possible to shorten the distance between Rodeo and Wildcat Creek near Richmond by 2½ miles by a major line change. The routing via the Benicia-Martinez ferry is also capable of improvement. The present state highway from Martinez to Crockett is very crooked and it could be straightened materially and widened, but it is probable that the distance can not be shortened materially over the present Franklin Canyon road. However, there will still be the disadvantage of using a ferry for crossing the bay against the bridge on the other route, and it will be shown that there was considerable heavier traffic via the Carquinez route before the bridge was built.

d. *Comparative traffic studies.*—The most general indication of the relative importance of each of the above routes from a traffic standpoint is a comparison of the number of vehicles using the Carquinez and Antioch bridges and the Benicia ferry. The total for July, 1928, was as follows:

Carquinez Bridge	136,248
Antioch Bridge	19,189
Benicia-Martinez ferry	15,715

Since figures prepared by the American Toll Bridge Company, who operate the Carquinez Bridge, show that the building of the bridge has apparently increased the total traffic via these routes some 33 per cent over what might be expected were the Rodeo-Vallejo ferry still in operation, it would be a fairer comparison of the relative importance of the different routes to show ferry traffic figures instead of the traffic over the Carquinez Bridge, which replaced it. The total vehicles in 1926 (which was before the opening of the bridge to traffic) were as follows:

Rodo-Vallejo ferry	599,155
Martinez-Benicia ferry	171,422

In addition to the Rodeo ferry traffic there were 113,200 vehicles which used the Monticello Steamship Company steamers direct into San Francisco, which traffic has fallen off over half since the bridge was built.

As shown by these figures, the importance of the Carquinez Bridge as a traffic artery is outstanding. An indication of where this traffic originates and is destined on the north side of the bridge is given by the state highway traffic counts at Napa Junction. The counts for July 15 and 16, 1928 (Sunday and Monday), are as follows:

	7/15/28	7/16/28
North of junction on Napa road	6961	2719
East of junction on Sacramento road	5620	2885
South of junction on road to Vallejo and the bridge	9282	4016

Counts show total traffic in both directions for 16 hours each day.

Sixteen hour traffic counts taken at Carquinez Bridge for same two days were 7084 and 3239 for Sunday and Monday, respectively.

Without an origin destination check it is not possible to say how many vehicles crossing the Carquinez Bridge are traveling to and from the direction of Napa and how many to and from the direction of Sacramento. It appears from the above counts, however, that the north and south traffic via Napa is somewhat larger at least on Sundays and holidays and about equal on other days.

As an indication of the present importance of a route from Napa Junction via the Black Point cut-off to Marin County and the Sausalito ferries the only recent available figures are the state highway traffic counts for January 15 and 16, 1928, at the Petaluma Creek Bridge east of the junction of the Black Point cut-off with the Redwood Highway south of Petaluma, and the count for the same days taken south of Napa Junction.

	1/15/28	1/16/28
South of Napa Junction	5553	2328
Petaluma Creek Bridge	1113	290

From an origin destination check of the transbay traffic between San Francisco and east bay points, made by the California Railroad Commission in August, 1928, the following table has been prepared. It will be noted that about 80 per cent of the total is inter-city traffic and that out of 136,000 vehicles crossing the Carquinez Bridge during the same month only about 32,000 came from San Francisco and the peninsula. Increased facilities for transbay travel, particularly to east bay points north of Oakland mole, will increase traffic over the Carquinez Bridge to a considerable extent.

TRANSBAY VEHICLE TRAFFIC

Crossing the Bay via	Total vehicle traffic in July, 1928	Between San Francisco and the Peninsula and				Livermore and San Joaquin Valley	Miscellaneous indirect traffic
		Sacramento and Napa Valley	Crockett and Antioch	Oakland and East Bay	San Leandro to Niles		
Oakland Ferries	246,000	10,180	4,080	207,010	3,860	19,070	1,800
Alameda Ferry	19,000	230	90	17,510	270	770	130
Berkeley Ferry	91,000	16,620	5,530	65,180	260	2,960	450
Richmond Ferry	10,000	3,700	660	5,240	90	310	0
Dumbarton Bridge	41,000	2,620	0	27,210	5,590	5,230	350
Transbay total	407,000	*33,350	10,360	322,150	10,070	28,340	2,730
Total per cent.	100	8.2	2.5	79.1	2.6	6.9	0.7

[illegible] vehicles for July, 1928, taken from records of California Railroad Commission for Southern Pacific ferries, records of Golden Gate Ferry Company and Dumbarton Bridge Company.

[illegible] Railroad Commission's origin-destination traffic check dated August 29, 1928.

[illegible] to their destination by a roundabout way, apparently having business at more than one point enroute or on a sightseeing trip.

*Comparison with check of route traffic via San Pablo Avenue indicates that between 1,000 and 2,000 vehicles whose destination is Sacramento do not go via Carquinez Bridge route.

e. *Legal and political data.*—The state highways which have been considered in the above discussion were included therein under the first highway bond act of 1909, they are:

Route No. 6—Sacramento to Woodland Junction.

Route No. 7—Woodland Junction to Benicia.

Route No. 14—Martinez to Oakland.

Route No. 8—Cordelia Junction to Ignacio, via Napa.

Route No. 1—(portion) Ignacio to Sausalito.

The law stated that "the route or routes of said state highways shall be selected by the Department of Engineering and said route shall be so selected and said highways so laid out and constructed or acquired as to constitute a continuous and connected state highway system running north and south through the state traversing the Sacramento and San Joaquin valleys and along the Pacific coast by the most direct and practicable routes, connecting the county seats of the several counties through which it passes and joining the centers of population, together with such branch roads as may be necessary to connect therewith the several county seats lying east and west of such state highway."

In accordance with this act, the highway commission chose a route from the Sacramento Valley to the bay district through Fairfield to the Benicia-Martinez ferry, then passing through Martinez the county seat of Contra Costa County running by way of Crockett and Rodeo, instead of though the Franklin Canyon. Only persons having business at places along the way now travel via Martinez and the state highway to reach Vallejo or points south of it and coming from Oakland direct to Martinez the Franklin Canyon road is the preferable way.

However, the present state highway having thus been established, it would be necessary in order to abandon any portion of it to get the county through which it passes to agree to take it over.

In order to connect up the state highway system to the Carquinez Bridge, it would be necessary to add to it either 12.8 miles of county road from Napa Junction or about 14.2 miles of new road for a more direct route from Cordelia going via the American Canyon.

f. *Summary and conclusions relative to Carquinez Straits and parallel bridges.*—The route from Sacramento to Oakland and San Francisco via state highway to Napa Junction, county road to the Carquinez Bridge and state highway again from the bridge to Oakland is a few miles shorter in distance than either the complete state highway route through Martinez or the Victory Highway via Antioch. The running time going via the Carquinez Bridge route is considerably less than via the Victory Highway and Antioch Bridge or via the state highway through Martinez although in the latter case the difference in time is practically all due to the difference in time of crossing a bridge instead of a ferry.

The state highway either via the Carquinez Bridge or via Martinez is more adaptable to being shortened and to improvement in traffic conditions than the Victory Highway. The proposed American Canyon cut-off would give the Carquinez Bridge route a still greater advantage over the state highway through Martinez.

The Carquinez Bridge also serves traffic from the east bay cities to the north coast county points better than the other two crossings can do it. Its importance as a traffic artery is proved by the record of traffic passing over it as compared to the Antioch Bridge and the Martinez ferry. Traffic studies indicate that the building of a bridge has increased the traffic about 33 per cent over what would be expected if the Rodeo ferry had been continued in service. Traffic over the Martinez ferry and via the Monticello Steamship Company has fallen off since the bridge was first opened to traffic.

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keley Ferry	91,000	16,620	5,530	65,0	260	2,960	450
mond Ferry	10,000	3,700	660	5,3	90	310	0
nbarton Bridge	41,000	2,620	0	27,2	5,590	5,230	350
ransbay total	407,000	*33,350	10,360	322,0	10,070	28,340	2,730
Total per cent	100	8 2	2 5	79	2 6	6 9	0 7

Total traffic to even thousand vehicles for July, 1928, taken from ords of California Railroad Commission for thern Pacific ferries, records of Golden Gate Ferry Company and Dumbarton Bridge Company.
Distribution of traffic from California Railroad Commission's origin—dtination traffic check date 1 August 29, 1928.
Indirect traffic includes all vehicles going to their destination by a roadabout way, apparently having business at e than one point enroute or on a sightseeing trip.
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At the present time the amount of traffic using the Carquinez Bridge and parallel routes, including the Monticello Steamship Company traffic direct to San Francisco, does not warrant the construction of another bridge either near Martinez or between there and the Carquinez Bridge where efforts to secure a franchise have been made.

Considering physical advantages and traffic conditions it appears that the logical route for a trunk line highway is via the Carquinez Bridge, with branch roads serving Martinez and Napa which are county seats and also serving as a part of alternate through highways. The Victory Highway route must be considered of secondary importance and its development as a trunk highway to the bay district wait until conditions require a second such route.

It must be remembered that in improving the present state road and connecting it with the Carquinez Bridge that traffic and consequent revenue is being brought to a privately owned bridge at the expense of the people of the state, and although the Antioch Bridge is not of primary importance in state highway traffic at the present time, it is impossible to ignore it from further consideration. As is shown later in the report, the common ownership of all these bridge and ferry crossings requires their consideration where the question of the state acquiring any one of them is concerned.

4. Upper San Francisco and San Pablo Bay bridges.

a. For transbay traffic north of the Golden Gate there are two existing routes: 1—The Sears Point toll road, 12.2 miles in length, which follows along the north shore of the bay from Vallejo and crosses the Napa River, Sonoma and Tolay creeks to a junction with the Black Point cut-off (Route 8 of the state highway system). 2—The Richmond-San Rafael ferry from Point Richmond to Point San Quentin.

Two toll bridges are proposed, one from Point San Pablo to McNears Point which route is just to the north of the Richmond-San Rafael ferry and will replace it, the other from Albany to the vicinity of Tiburon in Marin County (See Plate IV, p. 38).

To compare distances via these crossings the mileage from University and San Pablo avenues, Berkeley, to both San Rafael and Petaluma will be given, thus indicating their relative proximity to central Marin County and to the Russian River and north coast districts.

Berkeley to San Rafael:	
Via Sears Point toll road	50 miles.
Via proposed Richmond-San Rafael Bridge	18 miles.
Via proposed Albany-Tiburon Bridge	25 miles.
Berkeley to Petaluma:	
Via Sears Point toll road	51 miles.
Via proposed Richmond-San Rafael Bridge	40 miles.
Via proposed Albany-Tiburon Bridge	46 miles.

In both cases the shortest route is via the Richmond-San Rafael ferry or the proposed bridge that will replace it and the longest route is via the Sears Point toll road. It will be remembered that the latter also serves traffic from Napa and Sacramento valleys destined to Marin County and affords a quicker route for this traffic than the other routes do.

For comparative distances to northern Redwood Highway points the mileage from Berkeley to Cloverdale is given.

Via Richmond-San Rafael ferry and Redwood Highway	84 miles.
Via Carquinez Bridge, Napa, Calistoga and Alexander Valley road	97 miles.
Via Carquinez Bridge, Napa, Sonoma and Santa Rosa	105 miles.
Via Sears Point toll road and county road cut-off to Petaluma	97 miles.

b. *Highway connections and territory served.*—It is therefor seen that the Sears Point toll road is a direct conection serving traffic coming from Napa and Vallejo or points between, which is destined for Marin County or other points as far north as the Russian River resorts. From there on up the coast the traffic is served equally well or perhaps better by the routes through Napa and either Calistoga or Santa Rosa. Both these routes are paved or well surfaced, the former being a county road from Napa to the junction with state highway route No. 1 north of Healdsburg and the latter over state highway throughout except a short cut-off into Sonoma instead of following the state highway through Shellville.

The Richmond-San Rafael ferry or the proposed bridge affords the most direct connection from districts and connecting routes south of the Carquinez Bridge for traffic that has its destination in Marin County or the Russian River resorts. For traffic going up the Redwood Highway north of Santa Rosa it competes with the routes via Napa mentioned above.

The proposed bridge from Albany across the bay does not seem to have any advantages over the Richmond-San Rafael route except for traffic from Alameda County desiring to reach lower Marin County points including Mill Valley.

c. *Physical conditions and possible highway improvements.*—The Sears Point road is built on good alignment and level grade over tidal lands. It is surfaced with oiled gravel and will require considerable maintenance until the roadbed becomes compact and settled. A direct connection, 2 miles in length, is now under construction, leading to the county road between Vallejo and Napa Junction and it will ultimately join with the proposed relocation through American Canyon. However, for the traffic being considered here, the connection is through Vallejo to the Carquinez Bridge.

The present Richmond-San Rafael ferry connects with state highway route 69 at San Quentin and, at the other end with streets in the city of Richmond leading to several points along San Pablo avenue (route 4). It is proposed to construct a toll bridge about 2 miles to the north of the ferry which will also require the improvement of about 2 miles of road from Richmond to the bridgehead and of 2.5 miles of road from San Rafael to McNears Point in Marin County. The length of the proposed bridge structure will be 3.4 miles.

The proposed bridge from Point Fleming, opposite Albany, to Bluff Point about 2 miles from Tiburon and the terminus of state highway route 52, will be 6.5 miles long. It will require a connection from the bridgehead to San Pablo avenue, Albany (route 14) about one-half mile long, and the improvement of the 6 miles of state highway and 2 miles of county road in Marin County to bring them up to state highway standards.

d. *Comparative traffic studies.*—The existing transbay traffic north of the Golden Gate consists of that using the Richmond-San Rafael ferry averaging about 28,000 vehicles per month and the Sears Point road averaging about 20,000 vehicles per month. It is, therefore, impossible to compare the relative importance of the routes mentioned by the use of existing traffic figures. Since each of the proposed bridges is estimated to cost between fifteen and twenty million dollars it is evident that they must develop traffic far in excess of the present amount in order to pay any return to the owners.

e. *Legal and political considerations.*—The only consideration in connection with the acquisition by the state of any one of the above crossings is the necessity or advisability of adding another route to the highway system to serve one or both of the following purposes:

1. To provide a direct connection between the east bay districts and Marin County, there being no such existing state highway route, or,

2. To provide an additional route from the east bay to the north coast counties and the Redwood Highway. This is now served by the state highway and Carquinez Bridge route through Napa.

f. *Summary and conclusions relative to north bay crossings.*—There are at the present time two routes crossing the bay north of the Golden Gate, the Richmond-San Rafael ferry and the Sears Point toll road which follows along the north shore. Franchises have been granted for two proposed toll bridges with general routes from Richmond to San Rafael and from Albany to Tiburon.

The former bridge will afford the shorter route for places in the vicinity of San Rafael and to the north of there, and the latter will probably serve lower Marin County to better advantage. Both bridges are estimated by their proponents to cost between fifteen and twenty million dollars although the length of the former is 3.4 miles against 6.5 miles for the latter and it is thought that its cost will be higher than this estimate.

In order to support one of the bridges alone there will have to be traffic developed several times that now using the existing crossings.

5. Lower San Francisco Bay crossings.

a. Traffic crossing the bay to San Francisco and the peninsula may be divided into that traffic which originates along the east shore of the bay and that which originates along routes leading to Stockton and the San Joaquin Valley.

The bulk of the traffic from the east bay district naturally originates in the urban centers of Oakland and Alameda and to a less degree in the smaller centers of San Leandro, Hayward, Niles and other small towns along the highways leading south toward San Jose.

The east bay district is separated from the interior valleys by a range of hills or mountains with passes through which highways have been constructed. These are as follows:

The tunnel road east of Oakland which has been referred to before. This not only connects with the Martinez ferry and Antioch Bridge routes but also with the most direct route to Stockton via the Marsh Creek road and Borden Highway, all of it being county road.

The Dublin Canyon road running east from Hayward, which is a part of the state highway route 5 leading to Stockton and the rest of the San Joaquin Valley via Manteca.

The Niles Canyon road running east from Niles and joining with the Dublin Canyon road of the state highway system at Livermore. The portion from Niles to Livermore is county road.

The Mission Pass road running east from a point just north of Mission San Jose and joining the Niles Canyon road at Sunol. This is also a county road.

Of these four roads the Dublin and Niles Canyon roads are of particular interest at the present time. The former has a direct connection with the San Mateo-Hayward Bridge now nearing completion and the latter with the Dumbarton Bridge leading to Redwood City and Palo Alto. The tunnel road is of only minor importance in the consideration of the proposed inter-city bridge, and the Mission Pass road is used as a short cut from San Jose to the interior valley region.

Comparative mileages from Stockton and from Manteca on the state highway leading south through the San Joaquin Valley, to San Francisco over the various routes are shown on plate IV. From Manteca to the Civic Center in San Francisco the distances are as follows:

Via the San Mateo-Hayward Bridge and the Dublin Canyon, 88.6 miles of which distance 67.7 miles is state highway.

Via the Dumbarton Bridge and Niles Canyon, 100.0 miles of which distance 54.5 miles is over state highway.

Via the Oakland ferry and the Dublin Canyon, 73 miles not including about 3.5 miles of ferry travel. Of the total distance 54.6 miles is state highway.

Via the Foothill Boulevard from Hayward to Oakland the total distance is 74.1 miles and 58.6 miles of it is state highway.

These various routes and mileages are more clearly shown on Plate IV.

b. *Highway connections and territory served.*—The state highway from Stockton and Manteca running through Tracy, Livermore, the Dublin Canyon and Hayward is the most direct and centrally located trunk road. It connects with the west side highway of the San Joaquin Valley at Tracy and with other important county highways leading into Contra Costa County and to the delta region. The Borden Highway, which can be shortened somewhat by economic improvements, is a more direct route from Stockton and points north into the latter districts but cannot serve the other San Joaquin Valley points as well as the state highway. The route through Dublin Canyon being the nearest to the east bay cities is naturally a more important route than either the Niles Canyon or Mission Pass routes.

c. *Physical conditions and possible highway improvements.*—The state highway route via the Dublin Canyon is being improved as fast as time and a reasonable financial program will permit. The portion of the highway through the canyon has just recently been regraded and widened in accordance with present day highway standards. The county road from Livermore through Niles Canyon is paved and on fair alignment to Sunol Glen at the entrance to the canyon. The route through the canyon is crooked and narrow in many places, has 4 grade crossings, 5 bridges with sharp turns at the ends, 2 poor grade separations and one short tunnel. Owing to the narrowness of the canyon and the fact that there are two railroads that also use it, it is impractical to bring this road to the same standards as the Dublin

Canyon road, and particularly so while it remains under the jurisdiction of the county. The Mission Pass road is a fair graveled road used by a relatively small amount of traffic.

The connection to the San Mateo-Hayward Bridge on the easterly side is over a paved county road on fair standards of width and alignment from Castro Valley Junction east of Hayward to Mt. Eden. From there to the bridgehead 2.5 miles of narrow county road is being widened by the county and 2 miles of 30 feet concrete pavement is being constructed by the bridge company. On the westerly end the bridge company is also building a 30 foot concrete pavement to the Bay Shore Highway (route 68) opposite Fourth avenue, San Mateo.

The connections to the Dumbarton Bridge on the easterly side are over paved county roads with several jogs from the junction south of Niles to Centerville and Newark and just beyond the latter point joining with an oiled gravel road on dredger fill constructed by the bridge company. At the westerly end the bridge company's oiled gravel road over the tide flats joins with the county roads to Redwood City and Palo Alto. These county roads are paved although much of it is rather narrow oiled macadam and the general line is indirect, having several right angle turns in it. When the Bay Shore Highway is completed to a connection with the bridge road, probably two or three years hence, a very much better connection will be afforded for traffic going north and, of course, upon the final completion of the Bay Shore road to San Jose a reasonably good connection will be afforded for all travel across the bridge.

The present state highway route through Oakland requires traffic to use what are practically city streets from Hayward on to the ferry and into San Francisco. The Bay Shore Highway on the peninsula side, when construction work now under way is completed, will provide the best means of entrance into all sections of San Francisco.

There is a movement under way to improve the Borden Highway-Marsh Creek road, tunnel route, from Stockton direct to Oakland. Final improvements in alignment as recommended in the report made by the Division of Highways would shorten the distance to about 64 miles.

d. *Comparative traffic studies.*—As a measure of the relative use of the various routes into the interior described above the state highway traffic counts for July 1928 are given. They are:

Route	Sun.	Mon.
Dublin Canyon, count taken east of Hayward	7404	2672
Niles Canyon, count taken at Niles	2793	1149
Mission Pass, count taken at Junction with Rt. 5	1845	1056

On the same dates the traffic over the Dumbarton Bridge was 2689 and 852 vehicles respectively.

From the California Railroad Commission's origin-destination check, previously referred to and the July 1928 vehicle traffic counts, the following table has been prepared with particular reference to traffic from the peninsula to lower east bay districts and San Joaquin Valley routes. The estimated traffic that will use the San Mateo-Hayward Bridge does not take into account the increase in total traffic due to providing a new or improved traffic route. Traffic over the Carquinez

PLATE IV—Through Highway Routes Affecting Toll Bridges and Ferries Between San Joaquin Valley and Bay Districts. Opp p. 38.

ANALYSIS OF TRANSBAY VEHICLE TRAFFIC FOR JULY, 1928, BASED ON ORIGIN-DESTINATION CHECK OF CALIFORNIA RAILROAD COMMISSION, AUGUST, 1928

Via	Oakland ferries	Alameda Ferry	Richmond Ferry	Berkeley Ferry	Subtotal all ferries	Dumbarton Bridge	Total transbay traffic	Estimated portion of existing traffic San Mateo-Hayward Bridge
From San Francisco and Marin County to								
(a) East Bay cities and routes north of San Leandro:								
Per cent	87 08	89 52	91 63	93 43	88 92	5 99	80 55	
Number	214,217	17,008	9,163	85,021	325,409	2,456	327,865	20,000
(b) San Leandro to Niles:								
Per cent	1 48	1 19	0 88	0 29	1 13	3 32	1 37	
Number	3,641	226	88	264	4,219	1,361	5,580	5,000
(c) San Joaquin Valley and Livermore:								
Per cent	7 54	3 81	3 08	3 25	6 17	5 10	6 05	
Number	18,548	724	308	2,958	22,538	2,091	24,629	20,000
(d) Santa Clara Valley and coast:								
Per cent	0 45	0 71	0	0 08	0 36	0 62	0 39	
Number	1,107	135	0	73	1,315	254	1,569	1,000
From points Belmont to San Francisco County line to								
(a) East Bay Cities and routes north of San Leandro:								
Per cent	1 62	2 86	0 88	1 43	1 62	10 99	2 56	
Number	3,985	543	88	1,301	5,917	4,506	10,423	8,000
(b) San Leandro to Niles								
Per cent	0 02	0 24	0	0	0 03	2 93	0 32	
Number	49	46	0	0	95	1,201	1,296	1,000
(c) San Joaquin Valley and Livermore:								
Per cent	0 05	0	0	0	0 03	2 68	0 30	
Number	123	0	0	0	123	1,099	1,222	1,000
From points south of San Carlos to								
(a) East Bay cities and routes north of San Leandro:								
Per cent	1 30	1 43	3 53	1 36	1 38	54 99	6 78	
Number	3,198	272	353	1,238	5,061	22,546	27,607	13,000
(b) San Leandro to Niles:								
Per cent	0 07	0	0	0	0 05	7 39	0 79	
Number	172	0	0	0	172	3,030	3,202	2,000
(c) San Joaquin Valley and Livermore:								
Per cent	0 16	0 24	0	0 04	0 13	4 98	0 62	
Number	394	46	0	36	476	2,042	2,518	2,000
Miscellaneous indirect travel								
Per cent	0 23	0	0	0 12	0 18	1 01	0 27	
Number	566	0	0	109	675	414	1,089	1,000
Total per cent	100 00	100 00	100 00	100 00	100 00	100 00	100 00	
Total number	246,000	19,000	10,000	91,000	366,000	41,000	407,000	74,000 x 12 x 0 90= 799,000 per year

Divided as follows: North on San Pablo, 39,300; East Bay cities north of the estuary (except tunnel road), 249,039; Tunnel road, 7,209; San Leandro to Estuary, 38,500.

Bridge during its first year of service was practically double that over the ferry the year previous. Traffic over all routes passing through Vallejo and Benicia showed an increase of about 33 per cent over what would be expected by the normal increase in ferry traffic. Part of this increase, however, must be credited to the inauguration of the Berkeley ferry in June, 1927, a month after the bridge was opened to traffic.

A graphic record of vehicle traffic between San Francisco and east bay district via all ferry routes, prepared by the California Railroad Commission, is also shown here. The abnormal changes in traffic via a particular route due to providing other facilities and changes in toll rates are clearly shown thereon.

The San Francisco Bay Toll Bridge Company, owners of the San Mateo-Hayward Bridge have estimated the traffic which will use their bridge at 1,322,000 autos and 151,000 trucks, which is an 80 per cent increase in traffic over the estimate of present traffic that would be diverted over this bridge.

For a discussion of the location and expected traffic over a bridge connecting the municipal districts on each side of the bay, reference is made to the Report of the Board of Engineers, Transbay Bridge, San Francisco, May, 1927, and to the record of hearings before the Committee on Interstate and Foreign Commerce, House of Representatives, March 21-22, 1928.

An additional indication of the primary importance of local intercity travel over the ferries is given by the following figures also derived from the California Railroad Commission's origin-destination count.

Route	From San Francisco per cent	South on Peninsula per cent	Total per cent
North on San Pablo Avenue	10.70	1.00	11.70
East Bay Cities, Albany to San Leandro	75.86	3.07	78.93
Tunnel and Redwood roads	2.00	0.10	2.10
South on 14th Street and Foothill Boulevard	6.84	0.43	7.27
Total	95.40	4.60	100.00

e. *Legal and political data.*—The state highway route leading from the interior to the lower east bay district through the Dublin Canyon is of greater service than the other roads and questions to be considered relative to desirability of the state acquiring either or both the Dumbarton and Hayward-Niles bridges are the economic advisability of a transbay bridge on a state route instead of the present route via Oakland and the ferries and which of the existing or proposed crossings would best serve the public demand. In the case of taking over or building a bridge between the San Mateo-Hayward Bridge opposite the Dublin Canyon and the proposed intercity bridges mileage would be added to the state highway system without abandonment of any of the existing state road.

f. *Summary and conclusions relative to lower San Francisco Bay crossings.*—The existing state highway route, viz, Dublin Canyon route, to the lower bay region, seems to be the most logical one for a primary road. It is now constructed to higher standards, and carries more traffic than the other county highway routes via Niles Canyon and the Mission Pass.

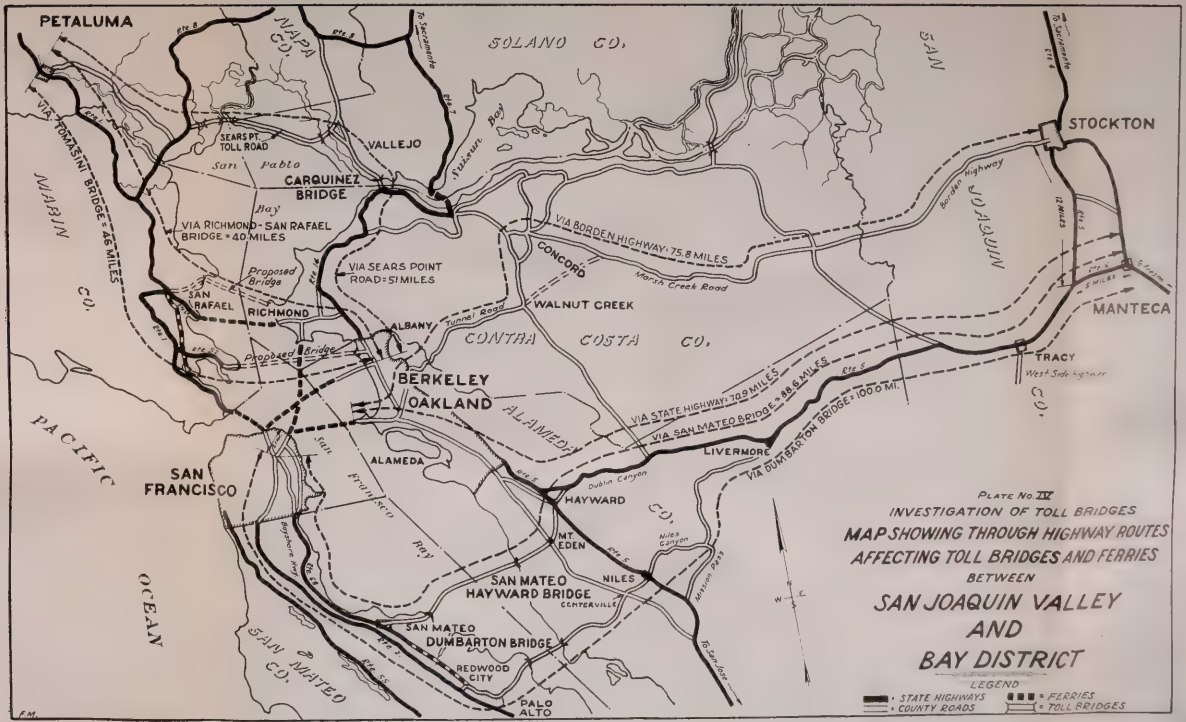


Plate IV—between 38 and 39.

The San Mateo-Hayward Bridge now nearing completion would afford a quick route for traffic from the state highway going direct into San Francisco and not desiring to pass through Oakland traffic. The Dumbarton Bridge opposite the mouth of Niles Canyon will then become of secondary importance so far as San Francisco traffic is concerned. The consideration of the proposed intercity bridge somewhere north of Hunters Point and Bay Farm Island is for the most part an intercity traffic problem, as only about 10 per cent of the traffic using the present ferries comes from outside the limits of San Francisco and the east bay cities, and less than 6 per cent goes via Dublin Canyon or other adjacent routes into the interior.

For a discussion of the location and traffic studies of the proposed intercity bridges reference is made to the numerous reports and discussions in connection therewith.

6. The Colorado River Bridge at Ehrenburg.

a. *Connecting highways.*—The Colorado River toll bridge at Ehrenburg is an interstate bridge forming the connecting link between the Mecca to Blythe road in California (state highway route 64), and the Ehrenburg to Phoenix road in Arizona. The bridge replaces a ferry which has been in service at this point for a great many years. (See Sect. I. Plate I-b, p. 13.)

The Ehrenburg Bridge was completed and opened to traffic in March, 1928. On June 14, 1928, one of the piers washed out and two spans dropped in the river. Repairs are now under way, but to date the bridge has not been reopened. Traffic is taken across the river by ferry as formerly.

The bridge is on the shortest and most direct route between Los Angeles and Phoenix. From Los Angeles to Mecca is paved highway (state highway routes 9 and 26). From Mecca to Blythe (91 miles) is an excellent desert highway (route 64) not paved. From Ehrenburg to Wickenberg (121 miles) is a rough desert road which has been used from fifty to seventy years, but has been improved very little. Parts of the road are very rough. From Wickenberg to Phoenix there is 38 miles of graveled road and 16 miles of pavement.

There are two other highway bridges over the Colorado River between California and Arizona: the bridge at Topock south of Needles at the eastern terminus of state highway route 58, and the bridge at Yuma on state highway route 27. There is also a ferry at Parker. The road via Topock is a good desert road and connects with a fair graveled highway in Arizona.

The road via Yuma is the heaviest traveled connecting road between California and Arizona. It is paved or has first-class surfacing all the way from Los Angeles to Yuma and connects with a good graveled road in Arizona. Hassayampa to Phoenix (44 miles) is paved.

Comparative mileages from Los Angeles to Phoenix are as follows:

Los Angeles to Phoenix via Ehrenburg	418
Los Angeles to Phoenix via Yuma	479
Los Angeles to Ash Fork via Ehrenburg	482
Los Angeles to Ash Fork via Topock	502

From Los Angeles to Phoenix it is therefore 61 miles shorter by way of Ehrenburg than by Yuma, and from Los Angeles to Ash Fork and

the Grand Canyon, it is 38 miles shorter by way of Ehrenburg than by way of Topock.

b. *Territory served.*—The Ehrenburg Bridge is about three miles east of Blythe, which has a population of approximately 2000 and is the largest town in the Palo Verde Valley. This valley, about twenty miles long and five to ten miles wide, is situated in the southeast corner of Riverside County along the Colorado River. The lower end of the valley is in Imperial County. The population of the valley is about 7500.

The irrigation system is highly developed and is a veritable garden spot in the desert. Cotton is one of the chief crops. Alfalfa, fruits, and garden produce are also grown. The country surrounding the valley on all sides is barren desert, with no industry except mining. Aside from a gas station or two, there is no habitation between Mecca and the valley, a distance of 90 miles.

On the Arizona side of the river there is practically no agricultural development. The local traffic crossing the river at present is therefore very small. The towns along the road between Ehrenburg and Phoenix have only a few hundred inhabitants.

The construction of the Boulder Dam will undoubtedly increase the area to be put under irrigation, and may change very radically the local conditions in this part of California and Arizona.

c. While the road from Mecca to Blythe is now maintained in good condition, the first 45 miles to Desert Center from Mecca has never been improved to final line and grade. This improvement is on the next biennium program. From Desert Center east to Blythe, the road has been graded and the last 30 miles has an oil-mixed surface. The road in Arizona is practically unimproved for a long distance. The improvement of this road would undoubtedly increase the traffic by this route very materially. The three and one-half miles from Blythe to the bridge are not state highway. The road and timber bridges on it are narrow and are not constructed for two-way traffic.

d. *Comparative traffic studies.*—Twenty-four hour traffic counts taken at the Ehrenberg Bridge for four days, May 27 to May 30, 1928, showed the following totals:

Sunday,	May 27, 1928, total vehicles	48
Monday,	May 28, 1928, total vehicles	49
Tuesday,	May 29, 1928, total vehicles	31
Wednesday,	May 30, 1928, total vehicles	39

The bridge was in operation from March 15, 1928, to June 14, 1928. The company gave as the average traffic for this period 41 cars per day.

Sixteen-hour traffic counts on route 58, route 64, and route 27, for July, 1928, were as follows:

	Sunday 7-15-28	Monday 7-16-28
Route 58, count at Needles west of city limits	611	471
Count near Bannock	194	237
Route 63, count at Blythe quarantine station	157	119
Count at Desert Center	84	58
Route 27, count at Yuma quarantine station	1922	1666
Count at Sand Hills maintenance station	492	396

e. *Legal and political data.*—As noted above, state highway route 64 ends at Blythe. The three miles of road from Blythe to the bridge is not state highway and is in need of widening and improvement. The Ehrenburg Bridge was opened to traffic in March, 1928, and at its meeting on April 19, 1928, the California Highway Commission voted "that the Director of Public Works cause a preliminary survey to be made on which to base a recommendation as to the inclusion in the state highway system of a highway from Blythe, Riverside County, to the new interstate bridge over the Colorado River between the states of California and Arizona, known as the Blythe-Ehrenburg Bridge." An engineering work order was issued in June to the District Highway Engineer for making this survey, but, since two spans of the bridge failed in the middle of June and repairs have not yet been completed, the making of the survey has been postponed.

f. *Summary and conclusions relative to southern interstate traffic.*—From the above traffic counts, it appears that the majority of the interstate traffic between California and Arizona now goes by way of Yuma. If the Arizona road from Ehrenburg east is improved and the district around Blythe develops due to the construction of the Boulder Dam, it is not unlikely that this shorter route via Ehrenburg will attract the greater part of the through traffic in the future.

SECTION V

REPORT ON EACH EXISTING TOLL BRIDGE PROJECT

(Including one bridge under construction)

1. Toll bridge projects to be described.

a. *The Carquinez and Antioch bridges owned and operated by the American Toll Bridge Company.*—The Antioch Bridge is of secondary importance, and the discussion of it is subordinated to the Carquinez Bridge. Such data as history, organization, financing and purchase by the state must be discussed collectively while data on the construction and operation of the bridges, with the cost thereof, can be taken up separately.

b. *The Sears Point cut-off bridges, owned and operated by the Sears Point Toll Road Company.*—The toll road with its three bridges must be considered as a whole in discussing its history, organization, financing, operation and cost while the design and construction of each bridge can be taken up separately.

c. *The San Mateo-Hayward Bridge, owned and operated by the San Francisco Bay Toll Bridge Company.*—This bridge is under construction at the present time and only estimated final costs of construction and estimated cost of operation can be discussed. Under present conditions this bridge should become an important connection to the state highway system.

d. *The Dumbarton Bridge, owned and operated by the Dumbarton Bridge Company.*—This bridge should become of secondary importance as a highway connection when the San Mateo-Hayward Bridge is built and will be discussed in less detail.

e. *The Ehrenburg Bridge, owned and operated by the California-Arizona Bridge Company.*—This bridge failed after being put in operation and steps are now being taken to place it in operation again, so that final construction costs and operating data can only be estimated. The bridge provides the only means of crossing the Colorado on state highway route 64, but traffic is very light over it.

These bridges were previously listed and their location is shown on Plates 1, 1a and 1b of Section I of this report.

The American Toll Bridge Company projects will be very thoroughly discussed and computations shown in detail in order to bring out the principles involved. These same principles are applied in the study of the other projects to give the results shown for each one.

CARQUINEZ AND ANTIOCH BRIDGES OF THE AMERICAN TOLL BRIDGE COMPANY

2. General data and information.

a. *General description of the project.*—The Carquinez Bridge is a steel and concrete structure 4982 feet in length which spans the Carquinez Strait at the entrance to San Pablo Bay. The strait is bounded on the north by Solano County and on the south by Contra Costa

County, the latter county being on the left bank of the stream, therefore, had jurisdiction in granting of franchise in accordance with the present law. The bridge is just south of Vallejo and its southern terminus is just west of Crockett.

The two main channel spans are of the cantilever type, each 1100 feet long and the clearance at pier 4, which is the low end, is 135 feet above highwater. The distance between trusses is 42 feet, which provides for a 30 foot roadway and two four foot sidewalks. The six concrete cylinders of piers 2 and 3 were constructed in water 100 feet deep and rest on bedrock 135 feet below the surface of the water.

Plate V, which follows, shows the general plan of the structure.

The Antioch Bridge is also a steel and concrete structure, 4639 feet long, which spans the San Joaquin River at a point about four miles east of Antioch. The main spans consist of one lift span and one fixed span, each of them 320 feet long, and there is 2080 lineal feet of steel and 1921 lineal feet of concrete viaduct. The clearance above highwater is 75 feet with the lift span closed and 135 feet with it open. The roadway width is 21 feet between curbs and there are no sidewalks. The pier foundations are supported on piling. Plate VI, which follows, shows the general plan of the structure.

b. *Name, address and officials of the corporation.*—The owning and operating company is the American Toll Bridge Company with offices at 525 Market Street, San Francisco. The officers of the corporation are: Oscar H. Klatt, president; George J. Calder, vice president; John T. Whitmire, secretary-treasurer; A. P. Hendrickson, comptroller. Board of directors—Oscar H. Klatt, chairman; George J. Calder, Charles G. Clyne, Dudley D. Sales, Roy O. Shurtleff, Nion R. Tucker, Frank D. Madison, E. M. Mills, Thomas B. Eastland.

c. *Properties owned and operated.*—In addition to the Carquinez and Antioch bridges described above, the American Toll Bridge Company owns (through purchase of stock) and operates the Martinez-Benicia ferry. This ferry also crosses Carquinez Strait but at the lower end of Suisun Bay between the towns named. The company also owned the Rodeo-Vallejo ferry which was replaced by the Carquinez Bridge and now has no value as a going concern.

d. *General relation to state and county roads.*—As has been described under Section IV, the Carquinez Bridge is a portion of county highway through Vallejo which connects with state highway route 8 at Napa Junction and with route 14 at the south end of the bridge near Crockett; the Antioch Bridge is a portion of county highway following the Sacramento River from Sacramento to Contra Costa County and the Martinez-Benicia ferry is a portion of state highway connecting route 7 at Benicia with route 14 at Martinez.

The bulk of the travel from the Sacramento Valley to the bay districts follows the route crossing the Carquinez Bridge instead of the Martinez-Benicia ferry or the Antioch Bridge. The Antioch Bridge is given consideration more on account of common ownership and relation to the Carquinez Bridge than on account of its importance as a state highway connection.

3. History and organization.

a. *Early history of the project.*—According to a history of the Carquinez Bridge, prepared by the toll bridge company, Aven J. Hanford in 1917 was the owner of a small but growing grocery business in Vallejo with stores in Oakland and Alameda. Hanford trucked his own merchandise and leaving Vallejo he had to travel the only possible route at that time, via Benicia, Martinez and the Tunnel Road, to reach his stores in Oakland and Alameda. Oscar H. Klatt was at that time a traveling salesman for a San Francisco wholesale grocery outfit and had to travel the same route as Hanford. As a result of their discussions as to how travel between Vallejo and the East Bay cities could be improved, the Rodeo-Vallejo Ferry Company was organized by them in 1918. On July 4, 1918, the ferry boat *Issaquah* made the first trip on the Rodeo-Vallejo run as an auto ferry.

Business increased steadily over the ferry and within a few years Hanford and Klatt felt that the eventual and proper means of crossing the strait was by means of a bridge. Therefore in February, 1923, the Rodeo Vallejo Ferry Company applied to the board of supervisors of Contra Costa County for a franchise to build and operate a toll bridge across Carquinez Strait. Other applications for franchises to bridge the strait were filed about the same time, all of which were denied by the board of supervisors, namely:

Name of applicant	Date filed	Location
Dillon Point Development Company	9-14-22	Dillon Point to Eckley
San Francisco Transit Company	9-14-22 and 3-5-23	Dillon Point to Eckley
Crockett Land and Cattle Company	3-5-23	Near Crockett to a point near Great Western Power Company's bridge

Later on, July 27, 1926, The Northern California Development Company, a corporation, presented an initiative petition to the board which was also denied. The matter was taken up to the Supreme Court and the action of the board was sustained by it. This application also covered a bridge located between Dillon Point and Eckley.

A franchise was granted by the board of supervisors on February 5, 1923, to the Rodeo-Vallejo Ferry Company for a toll bridge across Carquinez Strait and the approval of the War Department permitting its construction was secured April 17, 1923. Anticipating the approval of the War Department actual construction was started on April 2, 1923. Plates VII and VIIa show the general location of the American Toll Bridge Company's bridges and the Martinez ferry with the surrounding country and approach roads.

b. *Corporation history.*—The American Toll Bridge Company of California was incorporated under the laws of Delaware on May 28, 1923, with an authorized capital stock consisting of 750,000 shares of class "A" non-voting stock, par value $1 and 10,000 shares of class "B" voting-stock, no par value. The company was formed primarily for the purpose of constructing, buying or selling and operating toll bridges. Subscriptions were taken for 10 shares class "B" stock at $100 per

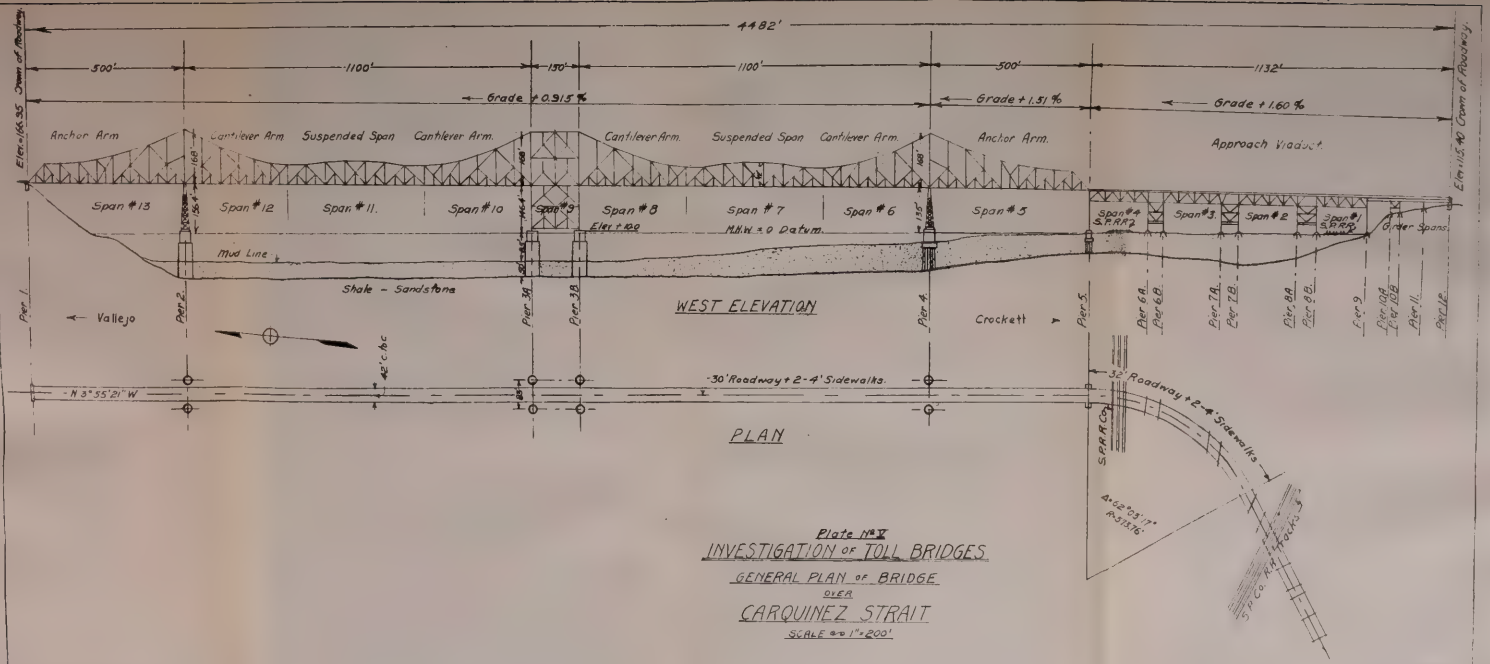


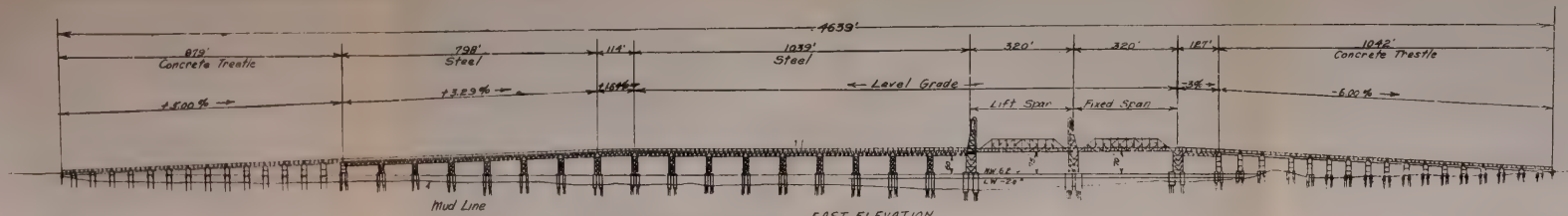
Plate No. V

INVESTIGATION OF TOLL BRIDGES

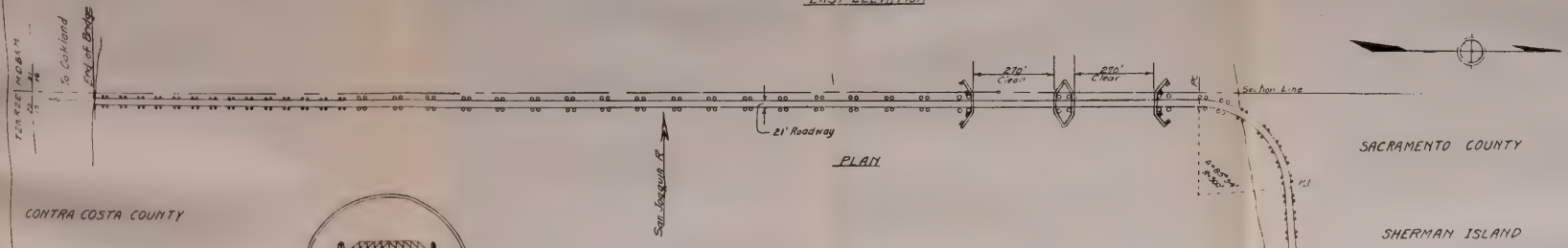
GENERAL PLAN OF BRIDGE OVER CARQUINEZ STRAIT

SCALE 0 to 1" = 200'

NOV. 30, 1929.



EAST ELEVATION



PLAN

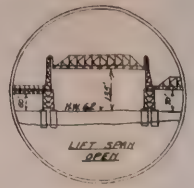


Plate No VI

INVESTIGATION OF TOLL BRIDGES

GENERAL PLAN OF BRIDGE OVER SAN JOAQUIN RIVER NEAR ANTIOCH

SCALE 1" = 200'

DEC. 11, 1928

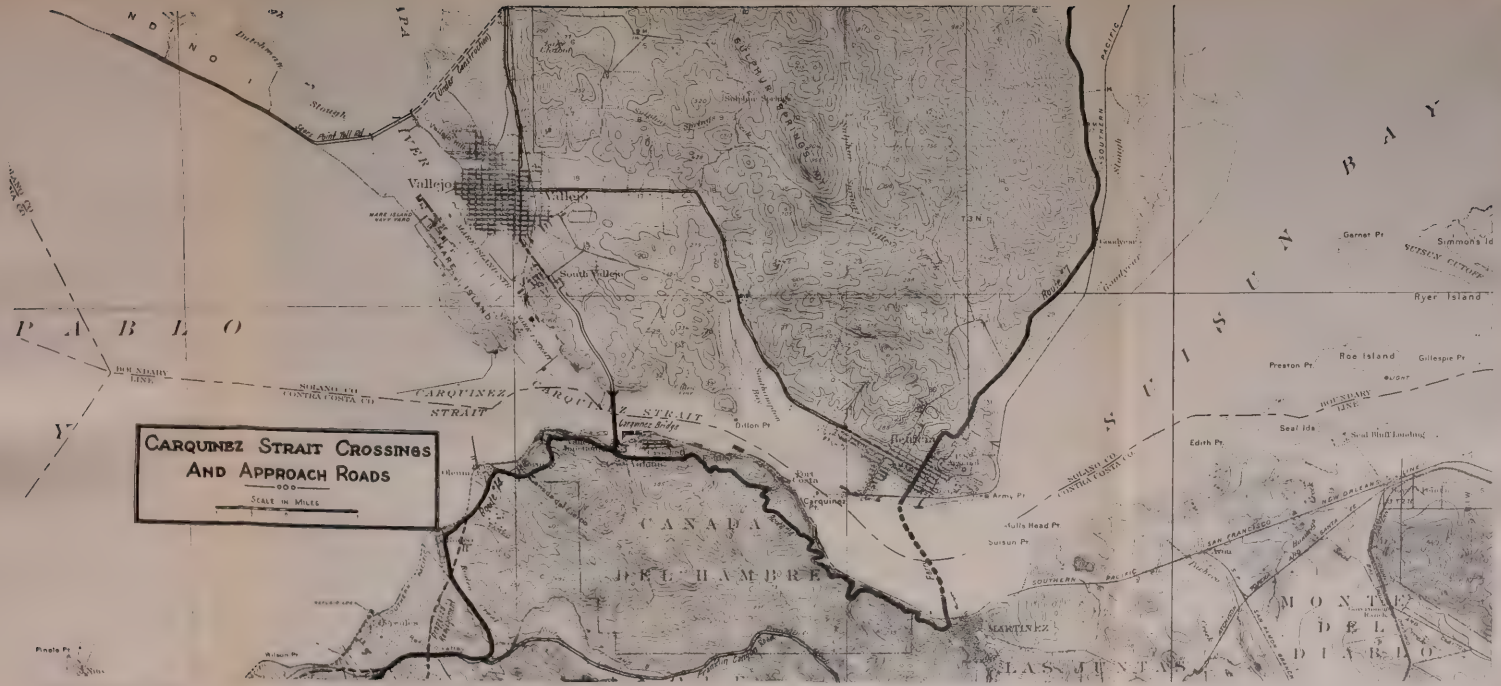


Plate VII—between 46 and 47

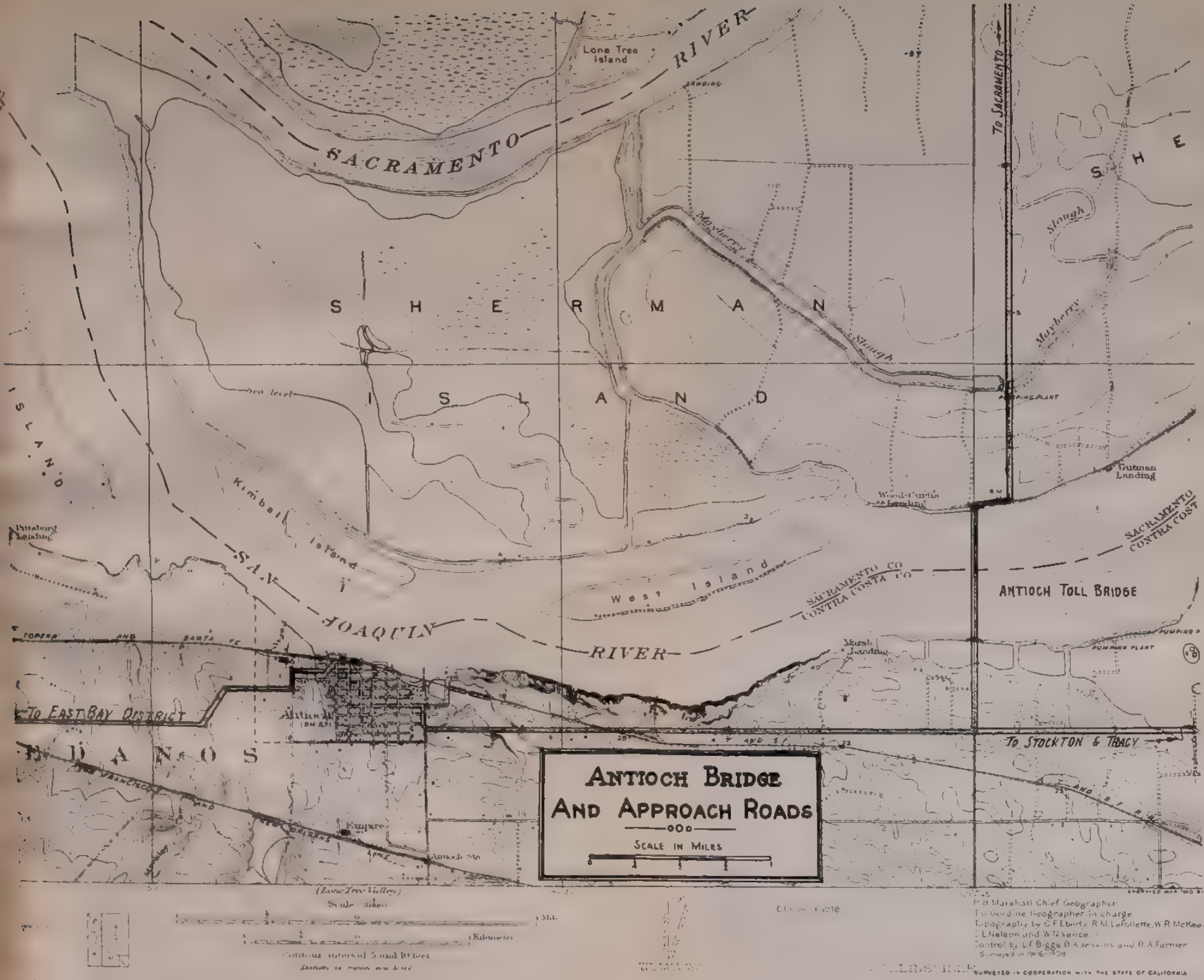


Plate VIIa—between 46 and 47.

share and the remainder of the capital stock was issued to O. H. Klatt and associates for the following assets taken into account at the values shown:

Ninety per cent of capital stock of the Rodeo-Vallejo Ferry Company, 1760 shares preferred and 2740 common	$2,499,500 00
All of the issued capital stock of the Delta Bridge Corporation, described below; 5 shares at	500 00
Land: 55 acres more or less bordering Carquinez Strait and one acre more or less bordering the San Joaquin River in Solano County; 19 acres more or less in Contra Costa County	1,500,000 00
Rights to franchises for construction of two toll bridges, over Carquinez Straits and over the San Joaquin River near Antioch	6,250,000 00
Total	$10,250,000 00

Against this the following credits to capital accounts were set up:

Class "A" stock	$750,000 00
Class "B" stock	999,000 00
Initial surplus	8,501,000 00
Total	$10,250,000 00

The American Toll Bridge Company was also incorporated under the laws of Delaware on May 28, 1923, with an authorized capital stock consisting of 5,000,000 shares of common stock, par value $1. The purpose of the company was the construction and operation of toll bridges, one across Carquinez Strait between the counties of Solano and Contra Costa and one across the San Joaquin River between the counties of Contra Costa and Sacramento. This company immediately issued to the American Toll Bridge Company of California $4,999,000 par value of its capital stock in exchange for the following assets which were taken into account at the values shown:

Land as described above	$1,500,000 00
Ninety per cent of capital stock, Rodeo-Vallejo Ferry Company	2,499,500 00
Contract with Rodeo-Vallejo Ferry Company relative to right to construct Carquinez Bridge and contract with the Golden Gate Ferry Company subsequently canceled	5,000,000 00
Franchise for constructing the Antioch Bridge originally given to the Delta Bridge Corporation (see below)	1,250,000 00
Issued capital stock of Delta Bridge Corporation	500 00
Total	$10,250,000 00

The difference between the above assets and the par value of the capital stock issued was credited to capital surplus.

Under date of September 1, 1923, the American Toll Bridge Company of California donated to the American Toll Bridge Company $1,000,000 par value of the capital stock of the latter company which had been acquired as described above. It was further agreed that of the remaining stock of the American Toll Bridge Company held by the other company, a number of shares not to exceed 1,500,000 would be sold outside of the State of California and the proceeds turned over to the American Toll Bridge Company.

The Delta Bridge Corporation which has been referred to in the above history was incorporated under the laws of California, December 21, 1922, with an authorized capital of 10,000 shares of $100 par value each. Its purpose was the construction and operation of a toll bridge across the San Joaquin River near Antioch according to the franchise granted it by Contra Costa County, June 4, 1923. This franchise was

later assigned to the American Toll Bridge Company of California and included in the assets of that company as listed above. The building of a bridge to replace the then existing Lauritzen ferry above Antioch was being promoted as a part of the reconstruction and paving of the final link in the Victory Highway and the officials of the American Toll Bridge Company undoubtedly undertook the construction of a toll bridge here in order to protect their investment in the Carquinez bridge against the possible competition of a free bridge. The approval of the War Department was secured for this bridge December 20, 1923, and construction began April, 1924.

As the Rodeo-Vallejo Ferry Company was an important factor in the organization of the American Toll Bridge Company, further data on its organization will be given. It was organized under the laws of California, March 23, 1918, with a capital stock of 2000 shares at $100 par value each for the purpose of operating ferries across San Pablo Bay between Rodeo and Vallejo. The articles of incorporation were subsequently amended to increase the capital stock to 2000 shares of 7 per cent cumulative preferred and 8000 shares of common stock which were shown on the books opened June 22, 1918, as having a total par value of $200,000. Of this stock $55,500 was held in the treasury and 500 shares of the outstanding stock was issued to A. J. Hanford and O. H. Klatt in exchange for the wharf franchise and other rights held by them at Rodeo and an assignment of the lease from the city of Vallejo to Hanford as lessee of the Lemon street wharf. Wharves, landing, etc., were valued at $68,662.82 and steamer *Issaquah* $67,032.58.

On March 21, 1922, it agreed to purchase the competing Six-Minute Ferry Company for a price of $388,000, a value set by the California Railroad Commission, which included steamers, terminals, equipment, rights, etc.

c. *Franchise obtained.*—Franchises for both the Carquinez and Antioch toll bridges were granted before the present statute was passed which allows the granting of a franchise for fifty years instead of twenty-five years, as was the case at that time. Copies of these franchises, both of which expire in 1948, are appended to this report.

4. Financing of the projects.

a. *Sale of stock.*—As described in subsection 3b above, the American Toll Bridge Company of California acquired 4,999,500 shares of the stock of the American Toll Bridge Company, in return for certain assets. The total authorized stock of the latter company was 5,000,000 shares. The California company then donated back to the American Toll Bridge Company, 1,000,000 shares of the stock acquired and agreed to sell not to exceed 1,500,000 shares more outside of the State of California and turn over the proceeds to the latter company. On September 5, 1923, a permit was given the American Toll Bridge Company, by the corporation commissioner, to sell 1,000,000 shares of its stock at $2 per share, to net the company not less than $1.60 per share. The audit report of the companies' books by Haskins and Sells, San Francisco, June 30, 1928, states that 404,890 shares were sold under permit.

It is presumed that the transfer of stock between the owning and holding companies was for convenience in selling it in accordance with present corporation laws of the state.

The auditor's report also shows that on June 30, 1928, there was stock of the American Toll Bridge Company, held as follows:

By the American Toll Bridge Company of California	2,323,196 shares
Issued as a bonus to the underwriters	500,000 shares
Issued in payment of services in connection with stock sales	119,609 shares
Held in the treasury, of which stock 828,219 shares are in escrow for the conversion of second mortgage bonds	837,755 shares

Since the various amounts of stock shown do not account for the entire stock of the company, the following disposition was furnished by the American Toll Bridge Company, from their records:

Held by American Toll Bridge Company of California	2,323,196 shares
Bonus to underwriters	500,000 shares
Treasury stock	837,755 shares
In the hands of the public	1,339,049 shares
	5,000,000 shares

As the 1,339,049 shares in the hands of the public include stock given for services in connection with organization as well as stock sold for cash, a further division of this item was sought.

Additional information furnished by the company approximately accounts for this item as follows:

Sold by American Toll Bridge Company at $2 per share	404,890
Sold by American Toll Bridge Company of California, outside of state, price unknown	678,818
Issued for services (stock sales)	119,609
Issued for services (legal expense)	125,000
Issued for services (publicity Antioch Bridge)	10,000
Unaccounted for	732
	1,339,049

It is also understood that an additional 560,000 shares have been sold by the American Toll Bridge Company of California out of the 2,323,196 shares held by them at the time of the audit, so that there are now approximately 2,399,000 shares of American Toll Bridge Company stock in the hands of approximately 4000 stockholders. The $404,890 worth of stock sold by the American Toll Bridge Company was all in small lots.

b. *Funded debt.*—Beginning in April, 1923, the American Toll Bridge Company, employed the firm of Duncanson and Harrelson on a cost plus basis to make investigations and start the foundation work for the Carquinez Bridge, and also to construct the piers of the Antioch Bridge which work started early in 1924. The work was financed by stock sales, the proceeds of the Rodeo-Vallejo Ferry Company, and the personal fortunes of Hanford and Klatt. As the sale of stock did not proceed fast enough to allow the construction to proceed at a reasonable rate, it became necessary for the company to borrow money to complete the work.

Considerable difficulty was encountered in convincing the bonding companies that the Carquinez Bridge was a feasible project, and it was only after Duncanson and Harrelson had carried on the work far enough to prove that there was a suitable and safe method for

constructing the deep water foundations, that they would undertake the financing. It seems evident that the work of construction was considerably delayed on account of the lack of money at this time.

In April, 1925, Blythe, Witter & Company, San Francisco, Peabody, Houghteling & Company, New York, and Bond, Goodwin & Tucker, San Francisco, undertook the financing of the project and underwrote the bonds as follows:

First mortgage, 7 per cent bonds, due April 1, 1945, $4,750,000 authorized, $4,500,000 outstanding June 30, 1928. These bonds are a first lien on all the real property of the American Toll Bridge Company. Payments are to be made into a sinking fund to redeem them commencing March 1, 1929.

Second mortgage, 8 per cent bonds, due April 1, 1945, $2,000,000 authorized and outstanding June 30, 1928. These bonds are a second lien on all real property of the company and stock of the Rodeo-Vallejo Ferry Company. They are convertible into stock of the American Toll Bridge Company, at prices varying from $2 per share at the present time to $3 per share after 1934.

During October and November, 1928, the company purchased $38,000 par value of the first mortgage bonds for $37,755.

The initial bond discount and expense as set forth in the audit was as follows:

First mortgage bonds:	
Stock bonus to underwriters, 250,000 shares	$400,000
Attorneys' fees and revenue stamps	9,750
Discount on bonds, 10 per cent	450,000
Second mortgage bonds:	
Stock bonus to underwriters, 250,000 shares	400,000
Attorneys' fees, revenue stamps and filing fee	14,103
Discount on bonds, 10 per cent	200,000
Total bond discount and expense	$1,473,853

The net cash received for construction, from the sale of the $6,500,000 bonds would therefore be $5,826,147, not deducting any value for the stock.

The annual cost to the toll bridge company for the loan of $5,826,147 may be figured as follows:

Interest on $4,500,000 first mortgage bonds at 7 per cent	$315,000
Interest on 2,000,000 second mortgage bonds at 8 per cent	160,000
Annual sinking fund payment to redeem $673,853 bond discount and expiration at 4½ per cent in 22 years	18,500
Annual sinking fund payment to redeem $1 par value of 500,000 shares of stock in accordance with permit	13,750
Total annual cost	507,250

This annual cost is about 8.7 per cent on the cash received.

c. *Other sources of income for construction.*—As stated under subsection 3b above, the American Toll Bridge Company, owned 90 per cent of the capital stock of the Rodeo-Vallejo Ferry Company, and the auditors' report shows that the net advances made from its earnings to the Toll Bridge Company, was $326,390. On the opening of the Carquinez Bridge to traffic in May, 1927, the operation of the ferry was discontinued and its "going concern" value which had been

appraised, and was carried on the books at approximately $2,500,000, was at once reduced to its present salvage value appraised at $50,371.

The American Toll Bridge Company, has purchased 3918 shares of the Martinez-Benecia Ferry Company, to date and the income from the ferry operation, which is small, is an added source of revenue at the present time.

Attention is called to the fact that additional capital expenditures for construction are still being made, principally to complete the fender system for the main pier. The cost of this work is being paid out of current earnings with no increase in capital stock or bonded debt.

5. Preliminary investigation and design—Carquinez Bridge.

a. *Investigation of site, surveys and borings.*—It is understood that the first public discussion with regard to a toll bridge replacing the Rodeo-Vallejo ferry took place September 19, 1922. Extensive borings at each pier and other investigations were made by Duncanson and Harrelson, who began the work of constructing the bridge in April, 1923, and the records of the company show that these investigations were completed November 15, 1923. It is certain that other studies and investigations leading to the final location and type of structure were made before April, 1923.

It is also understood that a location for the bridge somewhat downstream from the present site was preferred by the engineers in charge. This would have avoided the curve in the south approach of the structure, but the present location was finally chosen to get away from right of way litigation and consequent delay to construction of the bridge. The curve in the approach has a radius of 574 feet with a central angle of 62 degrees, which is not quite as large a radius as present highway standards would prefer under these conditions, but considering the surface, width and superelevation of the roadway as built, it presents no unwarranted hazard to the traveling public.

The general geographical location of the bridge, considering topography, connections with routes of traffic and general economic factors seems to be as good as could be obtained. The exact location and alignment could have been improved by moving the south end down stream.

b. *Appointment of engineers and preliminary design studies.*—Charles Derleth, Jr., of Berkeley was appointed chief engineer for the American Toll Bridge Company. He employed Wm. H. Burr of New York as consulting engineer and David B. Steinman of New York as designing engineer.

Comparative design studies for bridges of different types and spans were made and are described by Mr. Steinman in the Engineering News-Record of March 12, 1927. From this article it seems that a thorough study was made as to the most suitable type of bridge. A suspension bridge with 1600-foot main span and two 800-foot side spans was first proposed, but the navigation interests objected to it on account of the location of the piers. A 1950 suspension span and a cantilever bridge with two 1100-foot main spans were then proposed, with a preference for the latter, which was estimated to cost $700,000 less than the other. The War Department approved the cantilever design and it was consequently adopted.

c. *Final design, plans and quantities.*—The design adopted for the Carquinez Bridge consists of a steel cantilever type bridge on concrete piers and footings. The two main cantilever spans are each 1100 feet long and the anchor spans 500 feet each. There is one central tower span of 150 feet and 1132 lineal feet of deck steel truss or girder spans. (Section V-2-a, p. 46, plate V, shows the general dimensions.)

The bridge piers are of concrete and rest upon the following materials according to the plan sheet giving the results of borings and test pile driving data:

Pier 1 (north abutment) on the sandstone of the north hillside.

Pier 2 on sandstone and shale about 135 feet below mean highwater.

Pier 3a on hard blue clay and 3b on sandstone, both at an elevation about 135 feet below mean highwater.

Pier 4 on concrete piles driven into sand and clay, the bottom of the pier being 51 feet below mean highwater.

Piers 5, 6, 7 and 8, concrete pedestals on timber piles driven into sand and clay.

Piers 9, 10, 11 and 12, on the shale of the south hillside.

The approximate quantities of materials used in the structure are (including caissons, falsework and docks):

Piling (untreated)	41,400 l. ft.
Piling (treated) falsework and docks	76,400 l. ft.
Piling (concrete)	14,625 l. ft.
Concrete (tremie)	6,028 c. y.
Concrete (piers)	39,460 c. y.
Concrete (roadway slab)	3,550 c. y.
Structural steel, medium	15,857,930 lbs.
Structural steel, silicon	10,327,500 lbs.
Structural steel, heat treated	2,848,000 lbs.
Reinforcing steel	2,032,300 lbs.
Hardware, etc., caisons, falsework and docks	482,000 lbs.
Steel guides for caisons	588,000 lbs.
Timber in cofferdams and falsework	8,200 M B.M.
Excavation, dry	2,160 c. y.
Excavation, deep well	14,300 c. y.
Excavation, open cofferdam	6,900 c. y.
Puddle for cofferdam (repairs to pier 4)	6,500 c. y.
Riprap, final estimated amount	190,000 tons

In addition to the above quantities there are the concrete piling and concrete to be placed in the fender for the main pier, also toll house, toll collecting equipment, lights and signals.

d. *Design loads and unit stresses.*—For this data the reader is also referred to the article of D. B. Steinman, designing engineer for the bridge, in the Engineering News-Record, May 12, 1927.

Briefly the bridge is designed to carry three lanes of 20-ton trucks, or two lanes of 20-ton trucks with an electric train between them, followed and preceded by a uniform load of 600 pounds per lineal foot of track. The electric railway loading consists of a train of 96,000 pounds, cars 60 feet long with wheel concentration of 12,000 pounds each. Proper allowances were made for wind pressure.

Preliminary investigation and design—Antioch Bridge.

a. *Investigation of the site, surveys and borings.*—The bridge is supported on pile foundations and although no details of the work of

investigating the foundations is known, it is apparent from the varying lengths of piles shown on the plans that test piles had been driven previous to the drawing of the plans in July, 1924.

It is understood that the first idea for a bridge replacing the ferry, then operating, contemplated a low level structure costing much less than the one finally built. Before the final approval of the plans by the War Department was obtained, consideration of protests from the shipping interests made changes in the design necessary, which included the raising of the grade of the bridge to provide a clearance of 75 feet across the entire channel and a clearance of 135 feet with the span raised. The raising of the grade required the building of trestle approaches on a grade and, on the north side, a curve of 300-foot radius and a central angle of 86 degrees was put into the alignment of the structure in order to join the county road which runs along the levee for a quarter of a mile before turning north across Sherman Island to the Sacramento River. Short vertical curves were placed at the tops of the approaches.

The vertical and horizontal curves are too sharp and the grade of the north approach somewhat too steep to conform with state highway standards. The width of roadway, 21 feet, was standard for two-lane state bridges at the time of construction, but has since been changed to 24 feet. The county road along the levee between the bridge and the turn onto the concrete pavement is narrow oiled macadam and the turn is very sharp. It is certain that if the location of the road and bridge had been laid out under state supervision the general layout would have been considerably changed.

b. *Engineers and preliminary design studies.*—Plans for the bridge, with the exception of the lift span, were prepared by Frank H. Reynolds of Sacramento, and J. G. Little of San Francisco was consulting engineer. The plans for the lift span were prepared by J. G. Little under the supervision of Harrington, Howard and Ash, Kansas City, as consulting engineers. Several revisions of the plans were made, particularly the main piers and the lift span. These changes seem to have been made for the purpose of providing a safer and more suitable structure than as first designed.

(Section V-2-a, p. 46, plate VI, shows general dimensions.)

c. *Final design, plans and quantities.*—The structure as finally built consists of a steel and concrete superstructure including one lift span, all supported by concrete piers or pedestals resting on pile foundations.

The south approach consists of 879 lineal feet of concrete trestle on a 5 per cent grade, the north approach of 1042 lineal feet of concrete trestle on a 6 per cent grade. The main spans, one a lift span and one a through steel truss, are each 320 feet long, and the remainder of the bridge across the channel consists of 98-foot deck steel truss spans, except that the length of those adjacent to the main spans is 104 feet. The floor is of concrete throughout.

The foundations of the south approach are concrete piles capped with concrete above the mud line. All other piers and pedestals rest upon timber piles, the bottoms of the piers being below the mud and low water lines. (See Plate VI, p. 46.)

The approximate quantities of materials in the bridge are:

Piling, treated, in fenders and dolphins	40,000 l. ft.
Piling untreated	49,000 l. ft.
Piling, concrete	7,000 l. ft.
Timber, treated, in fenders and dolphins	73 M B.M.
Concrete in footings, tremie	1,300 c. y.
Concrete in footings	7,100 c. y.
Concrete—reinforced	4,900 c. y.
Concrete railing	110 c. y.
Concrete counterweight	300 c. y.
Steel—reinforcing	910,100 lbs.
Steel—structural, trusses	3,893,000 lbs.
Steel—structural, towers	340,000 lbs.
Operating machinery, cables, sheaves, etc.	110,000 lbs.
Operating house, one 16 h.p. and one 60 h.p. gas engine.	
Excavation—pier cylinders	1,500 c. y.
Excavation—dry	1,200 c. y.
Riprap, estimated final amount.	
Approach, embankment, $2,500 spent to June 30, 1928, work in progress.	
Right of way	1.65 acres
Lights and signals, toll house equipment.	

d. *Design loads and unit stresses.*—The following design loadings are as given on the plans:

Live loads, for the floor system, two 15 ton trucks or 100 pounds per square foot.
Live loads, for the trusses, 100 pounds per square foot or 24,000 concentrated load on one truss.

Impact allowance. $\frac{100}{\text{L plus } 300}$

Wind loads shown are satisfactory according to state standards.

The concrete is specified as 6 sacks of cement per cubic yard or a nominal mix of 1:2:4. This corresponds to class "A" concrete of the state specifications which is used under similar conditions except where denser concrete is desired to protect the steel from salt air.

The design loads specified are suitable for state highway service. The alignment, grades and road connections are not up to present-day standards for a state highway structure.

6. Construction data—Carquinez Bridge.

a. *Contracts awarded and final payments.*—The following payments to contractors are as shown on the books of the American Toll Bridge Company.

Thos. C. McGill, for approaches to and excavation of pier 1, done in the fall of 1923	$11,296
Duncanson and Harrelson, for investigation work and construction of piers 4 and 5 and a portion of pier 3. Work done between April 2, 1923, and January 1, 1925, on basis of cost plus 6 per cent	652,529
Raymond Concrete Pile Company, for miscellaneous work of foundations during March and April, 1923, suit brought by contractor for breach of contract settled for $50,000. Figures apparently are total payment	110,023
Missouri Valley Bridge Company, for completion of foundations. Work done April, 1925, to August 23, 1926. Lump sum contract and extras	1,417,660
U. S. Steel Products Company, furnishing and erecting steel superstructure; work started November 19, 1925, completed about June, 1927. Lump sum contract	2,086,854

Duncanson and Harrelson, for placing concrete floor on superstructure; work began January 24, 1927, and completed April, 1927; competitive bids	108,328
Materials furnished by the company—	
Concrete, aggregate	81,359
Reinforcing steel	27,317
Healy and Tibbetts, for placing riprap around piers 2 and 3, July, 1926, to May, 1927	39,362

The total of these figures is within $2,000 of the total for construction contracts as shown by the auditors, amounting to $5,136,395. The difference may be due to small miscellaneous items omitted above.

b. *Construction of substructure.*—A description of the methods of constructing the foundations will be found in the following articles written by the engineers in charge of the work: C. Derleth, Jr., Engineering News-Record, September 24, 1925; and G. J. Calder, Engineering News-Record, March 24, 1927.

Briefly, all piers with the exception of 2 and 3 rested on pile foundations or on the rocky banks of the strait and presented no unusual construction difficulties. Piers 2 and 3 were sunk by the open-caisson method to the exceptional depth of approximately 135 feet below the water line, where they rest upon hard material. They consequently presented real engineering problems in the way of foundation work, but so far as can be learned the work was done in a satisfactory manner.

A study of the plans and the available records of the construction indicates that the foundations of this structure are adequate to support it. A possible exception to this statement is the case of pier 3 which, until the completion of the permanent fender system now under construction, might not have sufficient lateral stability to resist the impact of a large vessel striking against it.

c. *Erection of superstructure.*—The erection of the steel work by the United States Steel Products Company has been described in the following articles: Engineering News-Record, September 24, 1925, by C. Derleth, Jr.; Engineering News-Record, April 28, 1927, by C. F. Goodrich.

In brief, the erection was as follows:

The south approach and the south cantilever were erected on timber pile falsework. The north cantilever arm was erected by the use of a temporary steel bent and pier under the center of the span, from which bent the span was erected as a cantilever out to the main pier (pier 2). The shore end of the arm was erected on falsework and the steel bent was taken out after the span was erected and used as a portion of the center tower over pier 3. The center tower was erected by means of large cranes rented from the Navy Department. The other cantilever arms were erected simultaneously by derricks resting on temporary girders supported by the trusses themselves. The two suspended spans were erected on a dock a short distance from the bridge, transferred to barges, floated into position and raised into place by means of counterweights and cables with sheaves temporarily fastened to the steel of the adjacent cantilever arms. The chief advantage in thus erecting the suspended spans was the saving in time of completing the structure.

d. *Miscellaneous work.*—Under this head may be considered the road work necessary to complete the approaches to the bridge. On the north end the existing road was narrow and rough and led to the ferry landing at the bottom of the ravine to the west of the bridgehead. A joint road district, No. 7, was formed to build the approach to the bridge and the county undertook the paving and widening of a portion of its road south of Vallejo. The toll bridge company contributed about $42,500 to this work.

On the south side the state highway from the ferry landing onto the bridge head was narrow and crooked and not suited to handle the traffic that would go over the bridge. Accordingly a contract was let by the state for the regrading and surfacing of this road on proper standards at a cost of $225,419, of which amount the bridge company contributed $8,500 to pay for work at the bridgehead.

Protests from the shipping interests resulted in the War Department requiring a much more elaborate fender system for pier 3 in the main channel than was contemplated at the beginning of the job. A rock fill is now being placed around the pier, which is in very deep water, and it is proposed to drive concrete piles into this fill and surmount it by a concrete mat capable of resisting the impact of a ship striking it.

A description of this proposed fender will be found in the following references: C. Derleth, Jr., in Western Construction News, November 25, 1927; staff article in Engineering News-Record, November, 17, 1927.

The final cost of completing this fender is estimated to be close to $500,000.

Construction data—Antioch Bridge.

a. *Contracts awarded and final payments.*—The following major construction contracts were awarded on the Antioch Bridge, the amounts being as shown on the books of the company.

April 4, 1924:	
Contract on foundations	$36,461.23
September, 1924:	
Duncanson and Harrelson—Contract on foundations and approaches	852,348.39
October, 1924:	
Dyer Brothers—Contract for superstructure	326,096.77
Approaches	10,607.00
Miscellaneous	15,783.74
Riprapping around the piers is in progress, the amount spent to date being about	10,981.00

b. *Construction of substructure.*—All foundations are on either concrete or timber piles. The north approach is founded on ground which is apparently moving toward the river. Noticeable settlement and movement is apparent in this part of the structure. Detailed foundation data for the piers of this structure is not known at this time. No particular difficulties should have been encountered in constructing the piers as the type of foundation used is comparatively simple in character.

c. *Construction of superstructure.*—The erection of the superstructure for the Antioch Bridge was compartively simple in its nature and no particular problems or difficulty should have been experienced. No details are known at this time.

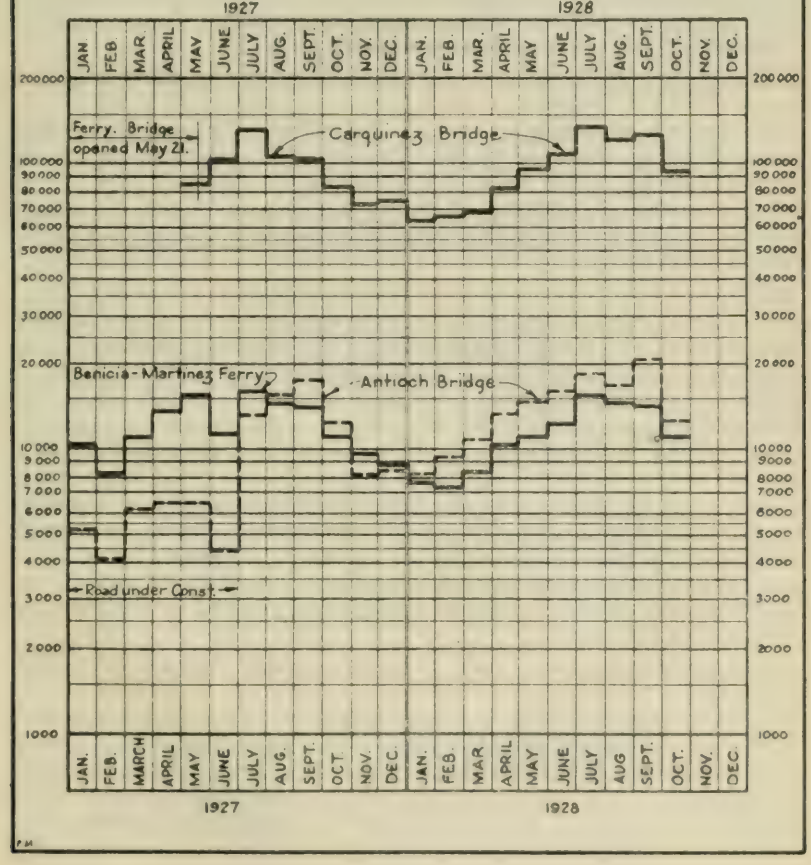
7. Traffic and income—Carquinez Bridge.

a. *Present traffic and income.*—The American Toll Bridge Company has kept in detail, daily records of all traffic which has crossed the bridge since it was built. Automatic counters are installed which check the detailed records of the cash registers. These traffic records have been furnished by the toll bridge company for use in this report and in addition traffic checks have been made by the division of highways.

PLATE No. VIII

INVESTIGATION OF TOLL BRIDGES

TOTAL MONTHLY AUTOMOBILE TRAFFIC CROSSING BRIDGES AND FERRIES LOCATED AT POINTS BETWEEN CARQUINEZ STRAITS AND LOWER SAN JOAQUIN RIVER.



The monthly traffic over this bridge since its completion is shown graphically on Plate VIII. On it there is also shown the monthly traffic since January 1, 1927, over the Antioch Bridge and the Martinez-Benicia ferry, both of which are owned by the American Toll Bridge Company. These graphs are principally of interest as showing the monthly variation in traffic caused by seasonal travel, State Fair travel in September, effect of poor approach roads in the case of the Antioch Bridge, etc.

The total number of vehicles crossing the Carquinez Bridge during the year ending June 30, 1928, was approximately 1,116,000. The total revenue obtained as shown by the company's statement of returns from operation for the same year was $916,428. Dividing this amount by the total number of vehicles gives $0.82 as the average toll collected from each vehicle.

b. *Estimated future traffic and income.*—On Plate No. VIII-a are shown graphs of auto registration for the state and for San Francisco Bay district only, total ferry traffic between San Francisco and the east bay and traffic over the Rodeo-Vallejo ferry and the Carquinez Bridge which superseded it. The actual traffic and automobile registrations during past years is plotted and also the predicted future amounts according to the various authorities shown on it.

The increase in traffic over any road or bridge is affected by two general causes or factors:

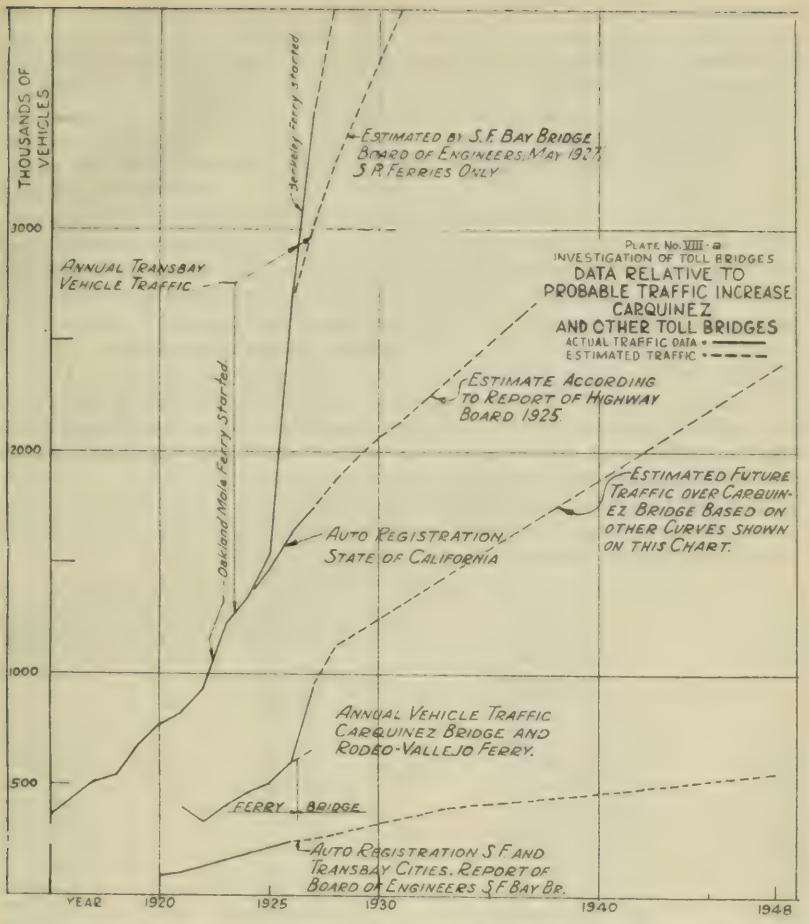
The increase in population and the general use of automobiles. This is represented by the yearly figures for automobile registration, for the whole state or any subdivision of it as may be thought to apply.

Changes in local conditions, such as improving the existing approach roads, providing new feeders of traffic, constructing alternate routes to divert traffic, etc.

Studies of the Division of Highways in regard to predicted future auto registrations indicate that a steadily decreasing per cent of increase may be expected. Auto registrations in the State of California were 1,350,400 in 1924; 1,700,000 in 1927 and according to the estimates of the Division of Highways, made in their study of probable income for highway purposes, will be 2,130,000 in 1931. The per cent increase for 1928 over 1927 is 7½ per cent, for 1929 over 1928 is estimated at 5½ per cent, for 1930 over 1929 is estimated at 4.6 per cent, 1931 over 1930 is estimated at 3.4 per cent and thereafter the estimated per cent of increase is approximately 3 per cent. It seems apparent that traffic over the Carquinez Bridge would be as much a function of the auto registration in the bay district as it would of the state in general and for this reason the figures for the bay district are also given according to the authorities cited.

Local conditions which may affect the traffic over the Carquinez Bridge are:

The development of the approach roads. The proposed American Canyon cut-off, shortening the distance to the Sacramento Valley by five miles, or the possible reconstruction of the highway south of Rodeo which will shorten the distance to Oakland by about two and one-half miles, should stimulate traffic over the bridge. A bridge or other improved facilities for crossing the bay from San Francisco to the east side north



of Oakland or the improvement and widening of the existing highway such as is about to be undertaken in the vicinity of Pinole, will also assist traffic.

Bridges across the bay from Marin County, such as the proposed Richmond-San Rafael or Albany-Tiburon bridges should divert considerable traffic between the east bay and Marin or Sonoma counties which now uses the Carquinez Bridge. Another bridge over Carquinez Strait would, of course, have a decided effect on traffic over the existing bridge.

It is very difficult to predict the future automobile traffic with any degree of certainty. The most careful studies and predictions made in the past have often been found to be considerably in error a year or two after they were made. In most cases the prediction has been below the actual traffic development but whether this condition will continue to apply to present and future predictions or a point of saturation for auto traffic will actually be reached or approached, is still problematical.

The curve of estimated future traffic over the Carquinez Bridge plotted on Plate VIII-a is based upon the average of auto registration

predictions as shown thereon. The effect of local conditions has not been taken into account. The very decided increase of traffic crossing the bridge in 1927 over 1926 is an interesting example of the effect of a change in local conditions. The increase is around 100 per cent but, as the computations of the officials of the bridge company indicate, the total increase of traffic across the strait was only about 33 per cent and the remainder of the increase was due to traffic diverted from the existing facilities, the Martinez-Benicia ferry and the Monticello Steamship Company. This increase of 33 per cent has been attributed to the construction of the bridge replacing the ferry, but it is very much of a question just how much was due to that factor and how much was due to the starting of the Berkeley ferry immediately afterward. This ferry increased the total transbay traffic over its normal amount by practically the amount carried by it and of this traffic a large per cent was destined to points north of the Carquinez Bridge. (See Section IV) p. 31.

The traffic prediction here made is considered conservative, the probable error not exceeding 10 or 15 per cent one way or another, assuming, of course, that no seriously competitive facilities are built before they become necessary from an economic standpoint.

The present average rate of tolls has been assumed to continue for the life of the franchise on which basis the following table of predicted traffic and income has been made.

Year	*Annual traffic*			*Yearly income*
1927	1,116,000	@	.82	$916,428
1928	1,125,000	@	.82	922,500
1929	1,195,000	@	.82	979,990
1930	1,250,000	@	.82	1,025,000
1931	1,310,000	@	.82	1,074,200
1932	1,370,000	@	.82	1,123,400
1933	1,430,000	@	.82	1,172,600
1934	1,490,000	@	.82	1,221,800
1935	1,550,000	@	.82	1,271,000
1936	1,615,000	@	.82	1,324,300
1937	1,680,000	@	.82	1,377,600
1938	1,750,000	@	.82	1,435,000
1939	1,810,000	@	.82	1,484,200
1940	1,875,000	@	.82	1,537,500
1941	1,940,000	@	.82	1,590,800
1942	2,000,000	@	.82	1,640,000
1943	2,060,000	@	.82	1,689,200
1944	2,120,000	@	.82	1,738,400
1945	2,190,000	@	.82	1,795,800
1946	2,250,000	@	.82	1,845,000
1947	2,310,000	@	.82	1,894,200
1948	2,365,000	@	.82	1,939,300

Traffic and income—Antioch Bridge.

a. *Present traffic and income.*—As on the Carquinez Bridge, the American Toll Bridge Company has kept daily records of traffic over the Antioch Bridge since its opening. Reference is made to Plate No. VIII for the graph of traffic. The Antioch Bridge was opened to traffic on January 1, 1926. Traffic was comparatively light up to July 11, 1927, due to the fact that the roads leading to the bridge were not completed until that time.

As a basis of computing income the period from July 1, 1927, to June 30, 1928, was used. The total number of vehicles crossing the

Antioch Bridge during this period was approximately 148,000. The total gross income over the same period was $124,673.91. These figures show an average toll per vehicle of 84.2c. Plate No. VIII above indicates that the peak month, September, was about 26 per cent higher in 1928 than 1927 but dropped back to approximately equal traffic for the month of October.

b. *Future traffic and income—Antioch Bridge.*—The conditions which may affect future traffic over the Antioch Bridge are similar to those affecting any other bridge. Of primary importance is the general feature of growth of automobile traffic as measured by the increase of auto registration. Future improvement of the roads leading to the bridge is also of primary importance. It will be noted in Section IV of this report, Plate No. III, p. 31, that there are many miles of county road on each side of the Antioch Bridge. It is probable that improvement of these county roads will be must less rapid than will the improvement of state highways. Improvement of the tunnel road out of Oakland, for which purpose a road district is being formed, will no doubt have an increasing effect on the traffic over the bridge. As shown on Plate VIII-a, p. 59, above, *the rate of increase* in auto registration is likely to *decrease* for a term of years until it reaches a constant annual increase of approximately 3 per cent after 1932 or 1933.

A traffic and income prediction for the Antioch Bridge based on predicted increase in auto registration is as follows:

TRAFFIC PREDICTION—ANTIOCH BRIDGE.
(July 1 to June 30—Each year.)

Year	Per cent increase	Traffic vehicles	Income
1927		148,000	$124,600
1928	6	157,000	132,200
1929	5	165,000	139,000
1930	4	171,800	144,600
1931	3½	177,900	149,800
1932	3	183,100	154,200
1933	3	189,000	159,100
1934	3	195,000	164,200
1935	3	200,800	169,100
1936	3	207,100	174,400
1937	3	213,400	179,700
1938	3	220,000	185,200
1939	3	226,600	190,800
1940	3	233,400	196,500
1941	3	240,500	202,500
1942	3	248,000	208,800
1943	3	255,000	214,700
1944	3	262,700	221,200
1945	3	270,800	228,000
1946	3	279,000	234,900
1947	3	287,500	242,100
1948	3	296,100	249,300
1949	Bridge reverts to county.		

8. Operation and maintenance—Carquinez Bridge.

From audit report by Haskins & Sells, July 1, 1927, to June 30, 1928. (See condensed statement of operations following this subsection.)

a. *Administration and advertising.*—The cost of administration which constitutes the head office expense and head office salaries for the period July 1, 1927, to June 30, 1928, was $73,600.97. The cost of advertising over the same period was $49,870.33.

b. The cost of collection of tolls including labor, power, light, telephone operating, supplies and expenses for the period was $40,656.79.

c. *Maintenance and repairs.*—The items of maintenance and repairs for the above period was very small, the amount expended for this purpose being only $344.97. The management evidently plans to pay these charges only as they occur rather than to set aside a yearly sinking fund for that purpose. The maintenance is naturally low over the first few years of the bridge's life. It is thought proper to set aside a sinking fund for this purpose and it is probable that a yearly sinking fund of $5,000 will take care of necessary painting and floor repair.

d. *Insurance and taxes.*—Taxes for the period from July 1, 1927, to June 30, 1928, were paid in the amount of $96,620.09.

Under the franchise the bridge company is required to pay 2 per cent of the gross income to the counties adjacent—1 per cent to each county. The bridge company has not paid this tax and has protested against doing so. It is understood that the counties have agreed to defer the collection of this tax for a period of five years, in accordance with their interpretation of existing laws. This tax, if paid for the period above, would have amounted to $18,328.56.

Insurance on the Carquinez Bridge for the above period of 1 year was $25,428.91.

Operation and maintenance—Antioch Bridge.

a. *Administration and advertising.*—The cost of administration, consisting of head office expense and salaries for the period July 1, 1927, to June 30, 1928, was $10,111.40, and the cost of advertising was $12,634.46.

b. The cost of collection of tolls, including labor, light, telephone, operating, supplies and expenses for the period was $11,056.32.

c. *Maintenance and repairs.*—As on the Carquinez Bridge, the items of maintenance and repair were very small, the amount expended for this purpose being only $15.85. As before, a sinking fund should be set up to take care of painting, fenders and floor repairs. It is probable that a yearly annuity of $1,400 will take care of these maintenance items.

d. *Insurance and taxes.*—During the year 1927 the bridge company paid $24,063.94 taxes on this structure. A 2 per cent gross income tax required in the franchise has not been paid, as stated above. This item, if it had been paid, would have been approximately $2,500 for the period June 30, 1927, to July 1, 1928. Insurance on the Antioch Bridge for the one year period was $9,492.36.

9. Interest and amortization.

a. *Interest on funded debt and working capital.*—Interest paid on bonds for the period July 1, 1927, to June 30, 1928, was $383,619.50 and interest paid on working capital was $5,616.84. The 2 per cent federal income tax amounted to $4,575.72. Amortization of bond discount was set aside to the amount of $74,824.08 (on both bridges). In 4b above it is shown that a sinking fund of $18,500 deposited yearly and compounded at 4½ per cent will amortize the entire bond discount and expense for both bridges in 22 years, at which time the franchise will have expired. It is, therefore, evident that this discount is being more rapidly amortized than the life of the franchise requires.

b. *Plan of amortization.*—The plan of amortization of the cost of the bridge that is being followed by the company is on approximately a straight line basis. The present plan is to pay or set aside for payment a yearly sum of about $350,000. This sum compounded at 4½ per cent will pay off the book cost of the bridge ($7,311,712) in 15 years.

To amortize this cost by 1948, the date of expiration of the franchise, a sinking fund annuity of $201,300 compounded at 4½ per cent and deposited for 22 years is all that is necessary. If the present plan is followed the construction cost will be amortized by 1942 and the sum now set aside for amortization will go to surplus or dividends.

c. *Dividends to stockholders and operating cost.*—No dividends have been issued to stockholders and examination of a condensed statement of the operating revenue and expense indicates a net loss of $173,843 for the period. It is, however, shown above that more funds are being set aside for bond discount amortization than is necessary, by a amount of approximately $56,300 annually and for the amortization of the cost of the bridge by an amount of approximately $148,700 annually. On the other hand, approximately $1,000,000 must be provided at the end of the franchise in order to reimburse the stockholders the amount of $1 per share in 1948 in accordance with the terms of the contract. To create this fund it is necessary to set aside $27,500 annually on a 4½ per cent basis.

Slightly offsetting these reductions in the amount of their figures is the lack of a sinking fund of approximately $5,000 per year for repairs and maintenance. The changes in operating cost, as described, would reduce it about $175,000 from that shown on the company's statement leaving a small net earning instead of a deficit of $173,843. It is not likely that the operating expense will increase to any great extent over the years to come. An addition must, however, be made to cover the added capital investment of $500,000 for the pier protection around pier No. 3 now under construction.

The yearly expense of this feature may be estimated as follows:

Amortization $500,000 over 19 years at 4½ per cent, $17,250.

The condensed operating statements of the American Toll Bridge Company covering both their bridges for the period July 1, 1927, to June 30, 1928, follows:

CONDENSED OPERATING STATEMENT JULY 1, 1927, TO JUNE 30, 1928

Item	Bridge	
	Carquinez	Antioch
Operating revenues	$916,428	$124,674
Operating expenses:		
Bridge operating	$41,002	$11,072
Publicity and traffic	49,870	12,635
Taxes	96,620	24,064
Insurance	25,429	9,492
General overhead	73,601	10,111
Total operating expense exclusive of depreciation and interest	$286,522	$67,374
Profit from operation before depreciation and interest	$629,906	$57,300
Depreciation and amortization of cost of bridge	349,506	78,443
Profit from operation	$280,400	$21,143

Interest and amortization of bond discount and expense	$454,243	$108,201
Loss for period	$303,187	
Other income	3,467	
Net loss	$299,720	
Deficit at beginning	95,711	
Adjustments of prior year, profit and loss	11,452	
Deficit at end of period	$406,883	

The operating cost based on a 22-year amortization period which is the franchise limit of toll collection, in comparison with the above, which is based on 15-year amortization, is as follows:

Total yearly operating expense (taxes and insurance)	$286,522
Amortization sinking fund cost of bridge:	
$7,311,712 over 22 years at 4½ per cent	201,300
Amortization sinking fund bond discount:	
80 per cent of $673,853 over 22 years at 4½ per cent	14,800
Amortization sinking fund stock bonus:	
80 per cent of $500,000 over 22 years at 4½ per cent	11,000
Interest on bonds and income tax and expense	393,812
Amortization fender: Pay back $500,000	17,250
Amortization fund to reimburse stockholders at $1.00 per share for 1,113,260 shares of stock in 1948. 22 years at 4½ per cent	30,600
	$955,284
Sinking fund for maintenance	5,000
	$960,284
Say.	$960,000

Referring to subsection 7b, p. 58, Carquinez Bridge, it will be evident (assuming the predictions are correct) that in 1928 there will be a deficit of approximately $37,500, according to the revised operating cost. In 1929, $19,900 would be available for dividends, in 1932 $163,400 would be available, in 1948, $979,300 would be available. On this basis, the possible dividends to stockholders, if the Carquinez Bridge is considered alone, may be expected to increase from a small present deficit in 1928 amounting to ½ of 1 cent on 4,162,000 shares of stock at par to a profit of approximately 23½ cents per share in 1948.

A table showing estimated net earnings for both the Carquinez and Antioch bridges with their capitalized values is appended to subsection 9, p. 66, and is referred to in the following discussions:

Interest and amortization—Antioch Bridge.

a. *Interest on funded debt and working capital.*—Interest paid on bonds for the period referred to was $91,380.50 and on the floating debt $1,337.98. The 2 per cent federal income tax on bonds was $1,089.97.

b. *Plan of amortization.*—The plan of amortization is the same as for the Carquinez Bridge; during the above period a sum of $78,442.36 was set aside for amortizing the cost of the bridge. This sum compounded yearly at 4½ per cent will retire the book cost of the bridge ($1,709,076.62) in 15¼ years. Tolls were collected in 1927 and the franchise expires in 1948, a period of 22 years. The bonds mature in 1945 but the theoretical sinking fund for amortizing the total cost of the bridge is figured for 22 years, which will also accumulate sufficient funds to retire the bonds in 1945.

The sum of $47,000 compounded yearly at 4½ per cent is sufficient to amortize the cost of $1,709,076.62 in 22 years.

A sum of $14,392.71 is being set aside by the company for the purpose of amortizing the bond discount and expense. The entire bond discount, including the stock bonus valued at $1 per share, was $1,173,853. Assuming that 20 per cent of this amount, or $235,000, is chargeable to the Antioch Bridge, then a sinking fund payment of $6,462 compounded yearly at 4½ per cent will amortize this sum in 22 years. From these figures for both the Antioch and Carquinez Bridge it will be seen that if the present straight line of amortization is followed that a large surplus over that actually required for true amortization will be built up prior to the date of payment of bonds.

It will then be possible for the bridge company to buy up on the open market a considerable amount of the outstanding bonds. It may also be possible for them to refinance the project at a lower rate of interest and take up the present bonds at their call price should business prospects make it economically advisable at any later date. Such a procedure would decrease the operating expense and increase the stock value. All computations of operating expense in this report are based on equal annual sinking funds payments throughout the life of the franchise.

c. *Dividends to stockholders and operating cost.*—No dividends have been issued to stockholders. Examination of the condensed statement of income and operating expense given under the discussion of the Carquinez Bridge, indicates a net loss for the year shown of $129,344. As stated above $34,442 more than is necessary is being set up for amortizing bridge cost and $8,328 more than is required for the amortization of bond discount and expense.

On the other hand, it is necessary to set up an additional sinking fund annuity of $1,400 to take care of necessary maintenance and repairs. It is also necessary to set aside an additional sinking fund annuity of $6,120 to amortize the redemption of $22,265 of stock figured at par (20 per cent of the excess liabilities over value of property) if the stockholders are to receive their money back at the end of the franchise when the bridge is to be turned over to the public. This cost has all been charged in the cost of operation of the Carquinez Bridge shown above, which will not materially affect the final results. From these figures it is seen that the sum of $40,972.71 may be deducted from the apparent deficit of $129,344 leaving an annual deficit of $91,371. The following summary is the estimated annual operating cost based on 22 year amortization:

Total yearly operating expense (from books of American Toll Bridge Co.)	$67,374
Amortization sinking fund (cost of bridge) 4½ per cent	47,000
Sinking fund for maintenance	1,400
Amortization sinking fund (bond discount) 4½ per cent	3,712
Amortization sinking fund: 20 per cent of $500,000 stock bonus	2,750
Bond interest and income tax	93,808
Amortization sinking fund (stock): all charges to Carquinez.	
	$216,444
Total amount operating expense—say	$216,000

It is probable that this yearly expense will not materially change over the life of the franchise unless the company is able to refinance at a lower rate of interest.

ESTIMATED NET EARNINGS FOR CARQUINEZ AND ANTIOCH BRIDGES AND CAPITALIZED VALUES

	CARQUINEZ BRIDGE			[illegible] AND ANTIOCH	
Year	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1927	$43,572*	$41,100*	$91,400*	$134,972*	$127,332
1928	37,500*	33,375*	83,800*	121,300*	107,957*
1929	19,980	16,784	77,000*	57,020*	47,880*
1930	65,000	51,486	71,400*	6,400*	5,070*
1931	114,200	85,342	93,200*	48,000	35,870*
1932	163,400	115,197	61,800*	101,600	71,628
1933	212,600	141,400	56,900*	155,700	103,556
1934	261,800	164,253	51,800*	210,000	131,754
1935	311,000	184,081	46,900*	264,100	156,321
1936	364,300	203,425	41,600*	322,700	180,196
1937	417,600	219,502	36,300*	381,300	200,502
1938	475,000	236,075	30,800*	444,200	220,707
1939	524,200	245,745	25,200*	499,000	233,964
1940	577,500	255,428	19,500*	558,000	246,803
1941	631,800	263,233	13,500*	617,300	257,396
1942	680,000	267,648	7,200*	672,800	264,814
1943	729,200	270,825	1,300*	727,900	270,342
1944	778,400	272,673	5,200	783,600	274,405
1945	835,800	276,282	11,200	847,000	279,923
1946	887,000	275,943	18,900	905,900	281,836
1947	892,200	274,845	26,100	918,300	282,520
1948	979,300	271,776	33,300	1,012,600	280,986
	$8,878,218	$4,017,822	$887,100*	$9,190,318	$3,488,005

10.—Present value of investment—Carquinez Bridge.

a. *Original cost less depreciation.*—As shown on the books of the American Toll Bridge Company, the cost of the Carquinez Bridge proper to the company was $7,311,713. This figure less depreciation may be taken as one method of figuring the present value of the bridge. This cost includes the following major items:

[illegible]	$5,211,982
[illegible]	376,358
Taxes, interest and bond [illegible]	7,774
[illegible], [illegible] and bond discount amortization	656,670
Organization and sales expense	997,200
	$7,311,713

b. A second method of computing the value of a toll bridge is one based on the probable income to stockholders.

Referring to the table of capitalized net earnings above, it is shown that the present worth of the predicated net earnings of the Carquinez Bridge is $4,017,822 assuming that this money would be invested elsewhere at 6 per cent to yield to obtain them. The present worth of the $1 par value of 4,017,822 shares of stock to be paid off in

1948,, when the bridge reverts to the county, is $1,580,404. This is the present amount compounded at 4½ per cent which will amount to $4,162,245 by 1948, 80 per cent, or $1,244,320, of which is charged to the Carquinez Bridge.

A sum of $4,017,822 plus $1,264,320 (the first being reinvested at 6 per cent and the second at 4½ per cent by the stockholders) or $5,252,142, will give the same return to the stockholders as will the predicated net earnings from the bridge and will also build up a fund by 1948 to pay off the stockholders at $1 per share.

This may be considered as the present value of the proportion of stock chargeable to the Carquinez Bridge considered as a separate project. Since a sinking fund annuity to retire the bonds has been deducted in computing the net earnings on the bridge, their retirement would have to be assumed by the purchaser in addition to paying the owner the above value for his interest in this project. The outstanding bonds against the Carquinez Bridge as prorated are 80 per cent of 4,500,000 first mortgage bonds, and 80 per cent of 2,000,000 second mortgage bonds, or 3,600,000 first mortgage bonds and 1,600,000 second mortgage bonds.

The first mortgage bonds are callable at 1.04 up to October 1, 1929, and the second mortgage bonds at 1.05 up to maturity. To retire the present bonds now and refinance the bridge, the following funds are necessary:

$3,600,000 @ 1.04	$3,744,000
1,600,000 @ 1.05	1,680,000
	$5,424,000

Combining the value of the stock with the funds necessary to retire the bonds and not considering the Antioch Bridge, we arrive at the amount required to take over the Carquinez Bridge at the present time, which is $10,676,142.

This sum may be considered an estimate of the present value of the Carquinez Bridge, from the stockholders' point of view, assuming that the Antioch Bridge had not been built or acquired.

e. A third method of computing the value of the Carquinez Bridge, and the one which probably gives the true value to the state more nearly than any other, is the estimated cost of reproduction of the bridge by the state as if it were to be financed and constructed by the state in a manner similar to all other state highway bridges.

The following estimates of cost to the state are based on prices which should afford a fair profit to contractors bidding on a competitive basis. The cost of financing is based in the first estimate on a rate of interest which is as high a rate as the state should ever have to pay on bonds which are a direct obligation of the state itself and in the second estimate on a rate of interest which it is estimated is the maximum the state would have to pay on bonds for which the income from tolls is made the sole security. Quantities, materials and type of structure are taken as for an exact duplicate of the structure as constructed.

Estimate No. 1, financed on the basis of 4½ per cent interest.

Cost of construction, not including pier fender	$4,750,000
Right of way	75,000
Interest during construction: $1,500,000 for 3 years, 2,000,000 for 2 years, 1,500,000 for 1 year @ 4½ per cent	540,000
Foundation exploration	25,000
Engineering and legal expense 6 per cent	291,000
Contingencies 4 per cent	194,000
Cost of construction and financing	$5,875,000
Fender to be constructed after bridge is in operation, at estimated cost of	450,000
Total final cost	$6,325,000

Estimate No. 2, financed on the basis of 6 per cent interest.

Cost of construction (not including fender)	$4,750,000
Right of way	75,000
Interest during construction	720,000
Foundation explorations	25,000
Engineer and legal expense 7 per cent	339,500
Contingencies 4 per cent	194,000
	$6,103,500
Fender to be constructed after bridge is in operation, at estimated cost of	450,000
Total final cost	$6,553,500

d. *Cost of operating a bridge constructed by the state.*—The cost of state operation of the bridge financed under estimate No. 1 will now be discussed.

For the sake of comparison the plan of amortization assumed will be to entirely write off the cost of construction by 1948 so that the bridge will then be a free bridge. The schedule of predicted income as computed above in 7b will be used.

For comparison with the privately owned bridge, taxes will be assumed in a proportional amount as taxes revert to the public, whether they are collected through bridge tolls or an equal amount of taxes is levied on other property due to the fact that no toll bridge exists to bear the tax burden.

The estimated cost of operation is then as follows:

Financed at 4½ per cent.

Administration	$30,000
Advertising	000
Cost of collecting tolls	40,000
Maintenance and repairs	3,000
Taxes (assumed as paid)	97,000
Interest on bonds, $5,875,000 @ 4½ per cent	264,375
Amortization of bonded debt 22 years @ 4 per cent	171,800
Amortization of fender and interest 20 years @ 4½ per cent = 20,250+14,370	34,620
Insurance	21,000
	$661,795

Financed at 6 per cent.

Administration	$30,000
Advertising	000
Cost of collecting tolls	40,000
Maintenance and repair	3,000
Taxes assumed	97,000
Interest on bonds 6,103,500 @ 6 per cent	366,210
Amortization of bonded debt 22 years @ 4½ per cent	168,200
Amortization of fender in 20 years @ 4½ per cent	14,350
Interest on fender @ 6 per cent	27,000
Insurance	21,000
	$766,760

Using the predicted income from traffic (paragraph 7b) tolls could be reduced under the first estimate to the amounts shown in column 1 and under the second estimate to the amounts shown in column 2 of the following table:

Year	Column No. 1	Column No. 2
1928	$0.59 per car	$0.68 per car
1929	0.55 per car	0.64 per car
1930	0.53 per car	0.62 per car
1931	0.51 per car	0.60 per car
1932	0.48 per car	0.56 per car
1933	0.46 per car	0.54 per car
1934	0.45 per car	0.51 per car
1935	0.43 per car	0.49 per car
1936	0.41 per car	0.48 per car
1937	0.39 per car	0.46 per car
1938	0.38 per car	0.44 per car
1939	0.36 per car	0.42 per car
1940	0.35 per car	0.41 per car
1941	0.34 per car	0.40 per car
1942	0.33 per car	0.38 per car
1943	0.32 per car	0.37 per car
1944	0.31 per car	0.36 per car
1945	0.30 per car	0.35 per car
1946	0.29 per car	0.34 per car
1947	0.29 per car	0.33 per car
1948	0.28 per car	0.32 per car
1949	Free bridge	Free bridge

Under the first plan of financing it is seen that the average toll necessary up to 1948 would be 38 cents per car. Under the second plan of financing it would be increased to 44 cents. Under private ownership, as shown in paragraph 7a, the average toll (p. 58) charges per car is 82 cents. In order to maintain a fair average return to stockholders on the predicted traffic figures, it will be necessary to maintain the present rate of tolls.

These comparisons are made to show the difference in cost of public service over the bridge as now owned and operated and as it would be had the bridge been financed by the State of California under either of the plans suggested. While the figures are fresh in the reader's mind it is proper to answer the question: Why is there such a large difference in these costs of service?

The principal reasons are as follows:

It is much more difficult to finance a privately owned toll bridge than a publicly owned one and a much higher rate of interest must

be paid in consequence. In order to avoid too high appearing interest rates, bond underwriters resort to heavy bond discounts and in this case they also demanded a large stock bonus.

The private company often has difficulty in selling its stock to the public. Twenty per cent of the stock sold is usually given away as commissions to brokers. Large expense is required in advertising stock campaigns as well as for attorney fees and organization expenses. Private bridge companies do not receive the competition in bidding on construction work to the same degree that the state does. They usually find it necessary to award the contract to the contracting firm which will take the largest block of stock in payment and as a result the contractors figure larger profits and the consequent cost is higher. Delays are often experienced, as was the case on the Carquinez Bridge, on account of the financing, the work is held up and spread out over a longer construction period and the attendant costs are correspondingly raised. Right of way matters are more difficult for the private company because of the fact that they do not have the same powers of condemnation as the state. Other minor advantages of public ownership are lower costs of administration and advertising and the omission of federal income tax.

The question is best answered in figures by comparative costs of operation.

Cost of operation under private ownership per year	$960,000
Cost of operation under public ownership if financed on the credit of the State of California	627,175
Cost of operation under public ownership if financed on the security of the bridge alone	735,410

Present value of investment—Antioch Bridge.

a. As shown on the books of the American Toll Bridge Company, the cost of the Antioch Bridge proper to the company was $1,709,076.62. This figure less depreciation may be taken as one method of computing the present value of the bridge. This cost of $1,709,076.62 consists of the following major items:

Construction cost	$1,241,491 24
Engineering and inspection	147,293 95
Taxes, insurance and bonds	15,348 50
Interest during construction	70,681 32
Bond discount and amortization	
Organization and sales expense	184,261 61
Purchase of existing ferry	50,000 00
Total book value	$1,709,076 22

As stated in Section IV, the only reason for considering the Antioch Bridge as state highway connection is the common ownership of this bridge and the Carquinez Bridge by the American Toll Bridge Company, who would not consider the sale of the Carquinez Bridge without selling or reducing their investment in the Antioch Bridge. The combined book value of the Carquinez and Antioch bridges is $9,020,788.

b. The second method of computing the value of these two bridges is based on the income-bearing value to the stockholders. In accordance with the net earnings estimated under subsection 7, p. 60, it is

shown in the table of net earnings, p. 66, that the present worth of the total outstanding stock of the American Toll Bridge Company (4,162,245 shares) is as follows:

Capitalized value of anticipated earnings at 6 per cent	$3,486,005
Present worth of par value of stock due in 1948 compounded at 4½ per cent	1,580,404
Total	$5,066,409

In addition to purchase of stock at its present value it would be necessary for the purchaser to assume the payment of the bonds.

Funds necessary to recall these bonds, as has been stated in the discussion of the Carquinez Bridge, amount to $6,780,000.

Combining the funds necessary to purchase the stock with funds necessary to retire the bonds gives the following purchase price for the Carquinez and Antioch bridges combined:

Buy stock	$5,066,409
Retire bonds	6,780,000
Total	$11,846,409

Comparing this combined present worth with that of the Carquinez Bridge alone, we find that the difference between the two figures is $1,170,300. The actual cost of the Antioch Bridge to the American Toll Bridge Company and the figure on which net income and present worth has been computed is $1,709,100. These figures indicate that the capital investment in the Antioch Bridge is $538,800 too high in order to invest the money elsewhere at 6 per cent and bring a return equivalent to the predicted earnings for the Carquinez and Antioch bridges combined. If the state desires to acquire the Carquinez Bridge alone and leave the Antioch Bridge still the property of the American Toll Bridge Company, it will be necessary to reimburse the American Toll Bridge Company to the extent of about $538,800 in order that they may earn on the remaining capital invested the same returns as if they were to invest the money at 6 per cent elsewhere.

For the Carquinez Bridge alone, the present worth based on predicted earnings, capitalized at 6 per cent is approximately $11,214,900.

c. A third method of computing the value of these bridges, and the one which represents more nearly the true value to the state than either of the former methods, is the cost at which the state can build similar structures. Two estimates will be made. First, the cost of building similar structures under state supervision as if they were financed and constructed in a manner similar to all other state highway bridges, and the money raised by bonds which are a direct obligation of the State of California. Second, the bridges to be contracted for and constructed as are all other bridges on the highway system but financed by income bonds which have as their sole security the income from toll alone and are only a moral obligation on the state. The only difference between the first and second plan is the difference in interest rate which will be paid for money; a rate not to exceed 4½ per cent interest can be obtained when the bonds are a direct obligation on the state, while a rate of 6 per cent should be more than enough when tolls are the sole security.

Estimate No. 1—

Cost of construction—Carquinez Bridge	$4,750,000
Cost of construction—Antioch Bridge	850,000
Right of way—Carquinez Bridge	75,000
Right of way—Antioch Bridge	1,500
Interest during construction—	
Carquinez Bridge	540,000
Antioch Bridge	60,000
Foundation exploration—	
Carquinez Bridge	25,000
Antioch Bridge	7,500
Engineering and legal expense—	
Carquinez Bridge, 6 per cent	323,400
Antioch Bridge, 7½ per cent	68,900
Contingencies—	
Carquinez Bridge, 4 per cent	215,600
Antioch Bridge, 5 per cent	46,000
Total cost	$6,962,900
Fender of Carquinez Bridge—	
To be constructed after bridge is opened to traffic	450,000
Final cost	$7,412,900

Estimate No. 2 differs from Estimate No. 1 only in that the cost of financing is higher.

Estimate No. 2—

Excess cost of financing over Estimate No. 1 (6 per cent rate of interest instead of 4½ per cent during construction)	$200,000
Additional legal expense, 1 per cent	63,000
Total cost, excluding fender	$7,225,900
Fender of Carquinez Bridge—	
To be constructed after opening of bridge	450,000
Total final cost	$7,675,900

d. *Combined cost of operation of both bridges if constructed and operated by the state.*—The combined operating costs based on Estimate No. 1 above will now be estimated. In order to compare with the bridge under private ownership, the costs of the bridges will be amortized by 1948, and the same estimates of traffic are used. Taxes will be assumed as for the privately owned bridge. The cost is as follows:

Administration	$37,500
Advertising	000
Maintenance and repair	1,400
Taxes	121,000
Interest on bonds at 4½ per cent	313,300
Amortization of bonded debt at 4½ per cent over 22 years	191,500
Amortization of fender and interest over 20 years at 4½ per cent	34,600
Insurance	30,000
Cost of collecting tolls	51,000
	$783,300

The combined operating cost based on estimate No. 2 above is likewise estimated:

Administration	$37,500
Maintenance and repair	4,400
Taxes	121,000
Interest on bonds at 6 per cent	433,600
Amortization of bonded debt 4½ per cent over 22 years	198,700
Amortization of fender in 20 years at 4½ per cent	14,400
Interest on $450,000 at 6 per cent	27,000
Insurance	31,000
Cost of collecting tolls	51,000
	$918,600

The combined operating expense of the Carquinez and Antioch bridges under private ownership was computed to be:

Carquinez Bridge	$960,000
Antioch Bridge	216,000
	$1,176,000

These figures indicate that the present annual cost of operation under private ownership is $392,700 more than the operating cost would be if the bridge had been constructed and financed by the state as a direct obligation on the state and $257,400 more than it would be if the bridges had been financed by income bonds which have as their sole security the income from tolls.

11. Summary, and discussion of methods of acquiring and operating by the state.

a. *Methods of acquiring.*—There are two ways by which the state can acquire a toll bridge, either by the purchase of a privately owned bridge or by constructing one themselves.

If a toll bridge is to be acquired by purchase from a private corporation either both parties must agree upon a value for the structure or the necessary legal machinery must be set up for the state to purchase it through condemnation or otherwise. It has been shown in the preceding section of this report that there are several viewpoints to be taken into consideration in order to establish the true value. Two general viewpoints to be considered are: first, the public's point of view which rests almost solely on the cost of service to the traveling public and, second, the viewpoint of the stockholders of a private corporation, which rests on a purely investment basis.

b. *Summary of values on which to base a fair purchase price.*—In this report the following different values have been given, either of which is a true value according to the viewpoint assumed to be the proper one.

Cost to the toll bridge company:

Book value of Carquinez Bridge	$7,311,712
Estimated cost of fender (under construction)	500,000
Final cost	$7,811,712
Combined cost (book value) of Carquinez and Antioch bridges	$9,020,789
Cost of fender (estimated cost to be constructed)	500,000
	$9,520,789
Estimated value to stockholders:	
Present worth of Carquinez Bridge alone	$11,214,900
Combined present worth of the Carquinez and Antioch bridges	11,846,400
Value to the State:	
Cost of reproduction of the Carquinez Bridge by the state:	
Financed on 4½ per cent basis	$6,325,600
Financed on 6 per cent basis	6,553,500
Combined cost of reproduction of the Carquinez and Antioch Bridges by state:	
Financed on 4½ per cent basis	$7,412,900
Financed on 6 per cent basis	7,675,900

From a study of these figures it is evident that the toll bridge company would object to any other method of computing a fair price except the one based on predicted future income.

c. Methods of financing by the state.—Inasmuch as an income basis for computing value is likely to be the only one which can be agreed upon, an analysis will be made of the annual cost of financing and operation, based on amortization within a period of 20 years. After this period the bridge would be made free of tolls. As has been stated before, two methods are considered possible by which the state can refinance these bridges.

By bonds which are guaranteed by the unrestricted credit of the State of California. These bonds can be paid off by collection of tolls or otherwise. An interest rate of not over 4½ per cent can be obtained on this class of security.

By revenue bonds secured solely by tolls to be collected from the bridges. A rate of 6 per cent interest is figured as a maximum rate for this class of security.

The cost of operation under above methods of financing is for the Carquinez Bridge, considered alone:

When financed at 4½ per cent:

Administration	$30,000
Cost of collecting tolls	40,000
Maintenance and repair	3,000
Interest on bonds at 4½ per cent on 11,214,900	504,670
Amortization of bonded debt	357,755
Insurance	25,000
	$960,425

When financed at 6 per cent:

Administration	$30,000
Cost of collecting tolls	40,000
Maintenance and repair	3,000
Interest on bonds 6 per cent on 11,214,900	672,840
Amortization	357,755
Insurance	24,000
	$1,128,595

NOTE.—It should be noted that the interest item is a large part of the operating expense.

Based on the above operating costs, the following table shows the tolls which would have to be collected to make the bridge free of tolls by 1949:

Year	Traffic Predicted	Average tolls necessary to pay a cost of operating amounting to $960,425 (4½ per cent money)	Average tolls necessary to pay a cost of operating amounting to $1,128,600 (6 per cent money)
1929	1,195,000	.81	.94
1930	1,250,000	.77	.90
1931	1,310,000	.73	.86
1932	1,370,000	.70	.83
1933	1,430,000	.67	.79
1934	1,490,000	.64	.76
1935	1,550,000	.62	.73
1936	1,615,000	.59	.70
1937	1,680,000	.57	.67
1938	1,750,000	.55	.65
1939	1,810,000	.53	.62
1940	1,875,000	.51	.60
1941	1,940,000	.49	.58
1942	2,000,000	.48	.56
1943	2,060,000	.47	.55
1944	2,120,000	.45	.53
1945	2,190,000	.44	.52
1946	2,250,000	.43	.50
1947	2,310,000	.42	.49
1948	2,365,000	.40	.48

Costs of operation for the Antioch and Carquinez bridges combined are:

Financed at 4½ per cent.

Administration	$37,500
Maintenance and repair	4,400
Interest on bonds at 4½ per cent on 11,846,400	533,088
Amortize bonded debt at 4½ per cent	377,900
Cost of collecting tolls	51,000
Insurance	30,000
	$1,033,888

Financed at 6 per cent.

Administration	$37,500
Maintenance and repair	4,400
Interest on bonds at 6 per cent	710,784
Amortized at 4½ per cent	377,900
Cost of collecting tolls	15,000
Insurance	30,000
	$1,211,584

The required average toll to be collected on both bridges would then be:

Year	Combined traffic both bridges	Average tolls necessary to produce a cost of operation amounting to $1,033,888 (4½ per cent money)	$1,211,584 (6 per cent money)
1929	1,360,000	.76	.89
1930	1,421,800	.73	.85
1931	1,487,900	.70	.81
1932	1,553,100	.67	.78
1933	1,619,000	.64	.75
1934	1,685,000	.61	.72
1935	1,750,800	.59	.69
1936	1,822,100	.57	.67
1937	1,893,400	.55	.64
1938	1,970,000	.52	.61
1939	2,036,600	.51	.60
1940	2,108,400	.49	.58
1941	2,180,500	.47	.56
1942	2,248,000	.46	.54
1943	2,315,000	.45	.52
1944	2,382,700	.43	.51
1945	2,460,800	.42	.49
1946	2,529,000	.41	.48
1947	2,597,500	.40	.47
1948	2,661,100	.39	.46
	Average toll	.517	.607

The tolls to be charged under private ownership to 1948 are 84.2 cents on the Antioch Bridge and 82 cents for the Carquinez Bridge.

SEARS POINT TOLL ROAD

2. General data and information.

a. *General description of the project.*—This road is located along the northerly shore of San Pablo Bay between Vallejo and a connection with the Black Point cut-off (state highway route 8) at Sears Point. At the easterly end a connection with the county highway running north from Vallejo to Napa Junction is under construction and the road is already connected with the city streets of Vallejo. Its westerly connection with route 8 of the state highway leads to Marin, Sonoma and the north coast counties.

The road is practically all over tidal flats and built on dredger fills. There are three bridges on it, viz:

A steel bascule bridge, of 97-foot span, over the Napa River, with 2249 linear feet of timber trestle approach. Width of roadway, 24 feet. This bridge is located at the northerly limits of Vallejo.

A steel bascule bridge, of 82-foot span, over Sonoma Creek, with 962 linear feet of timber trestle approach. Width of roadway, 24 feet. This bridge is located about 8 miles west of Vallejo.

A timber lift bridge, of 65-foot span, over Tolay Creek, with 148 linear feet of timber trestle approach. Width of roadway, 24 feet. This bridge is located near Sears Point Junction.

The road is surfaced with oiled gravel throughout.

Plates IX, IX*a*, IX*b*, which follow, show the general plan of the structures.

b. *Name and address of owning corporations and officials.*—The bridge is owned and operated by the Sears Point Toll Road Company, a corpo-

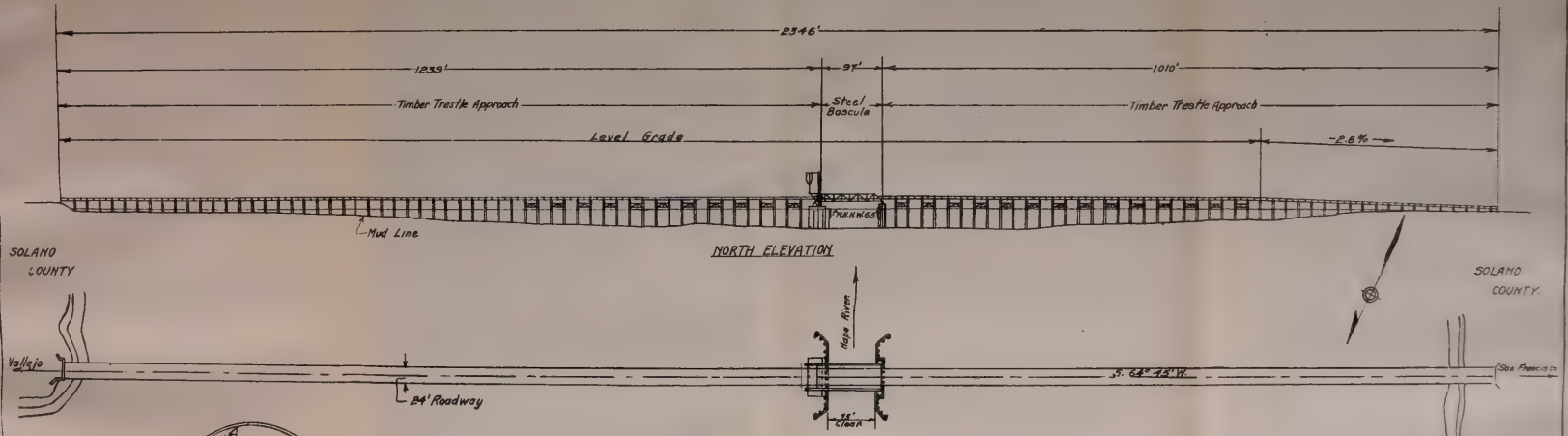


Plate No. IX

INVESTIGATION OF TOLL BRIDGES

GENERAL PLAN OF BRIDGE OVER NAPA RIVER NEAR VALLEJO

SCALE = 1" = 100'

DEC 18, 1928

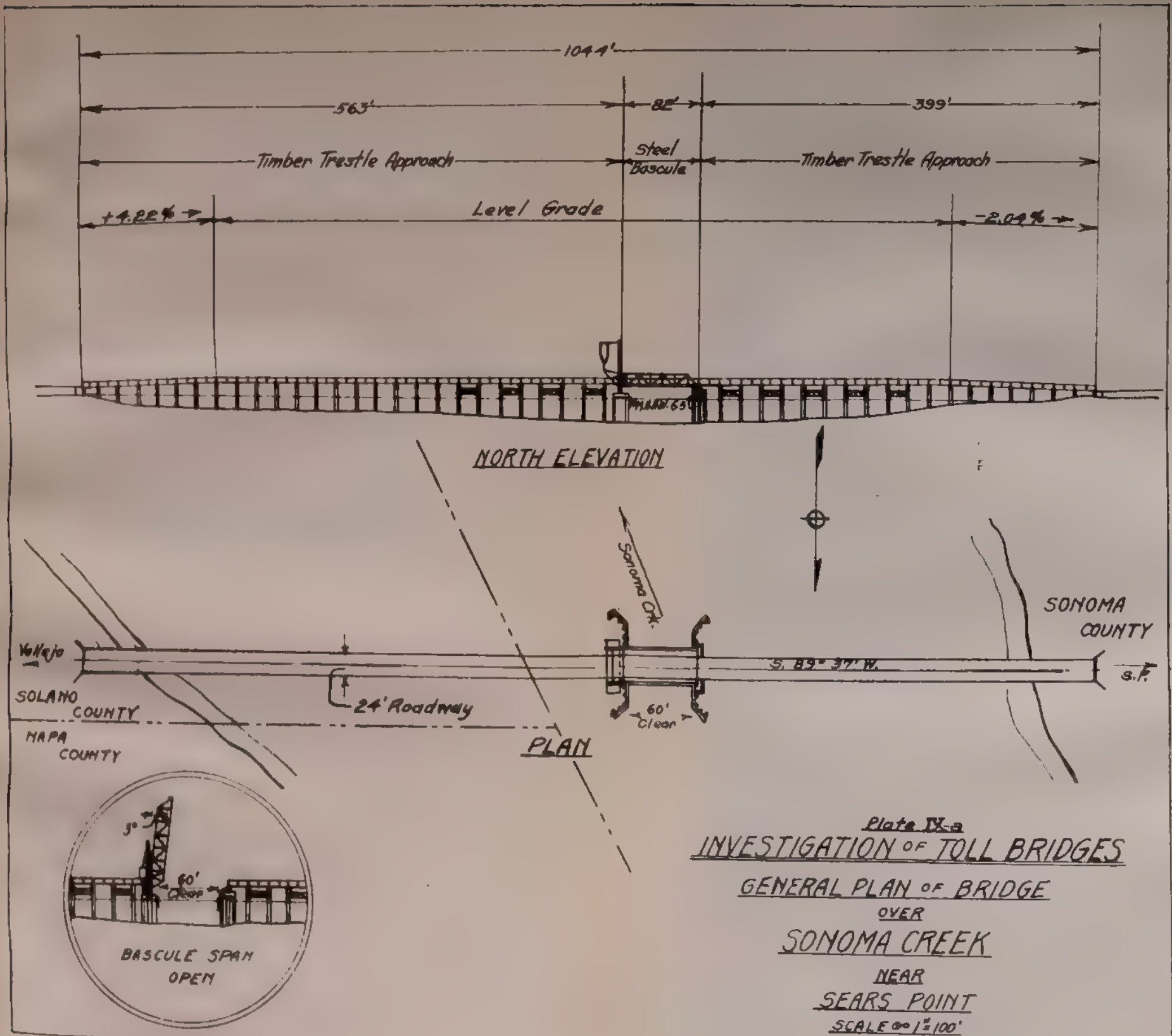


Plate IXa—between 76 and 77.

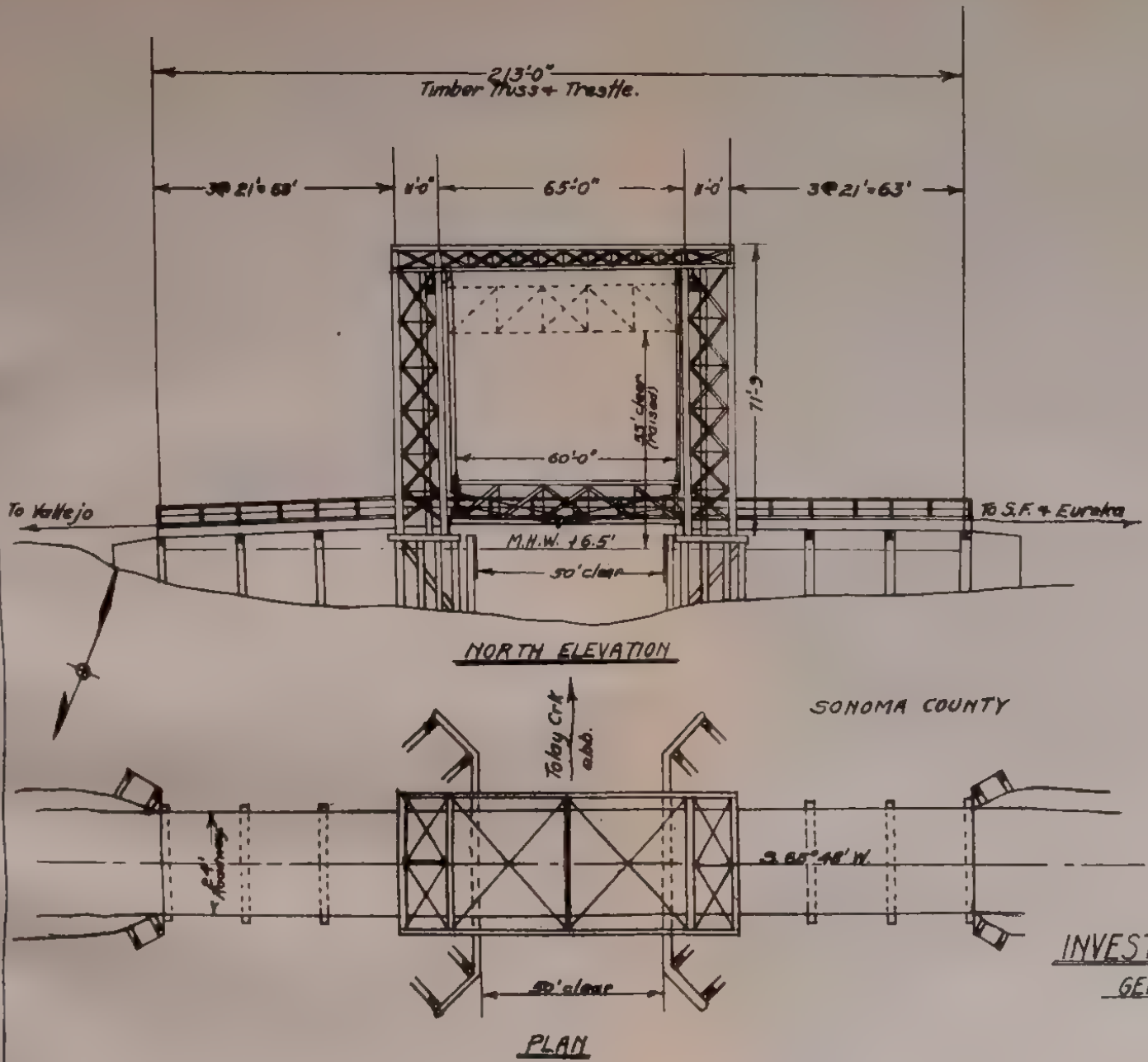


Plate IX-b

INVESTIGATION OF TOLL BRIDGES

GENERAL PLAN OF BRIDGE OVER TOLAY CREEK NEAR SEARS POINT

SCALE OF 1"=30'-0"

Dec. 1928

Plate IXb—between 76 and 77.

The officials are: A. O. Stewart, president and director; H. E. Speas, vice president and director; G. T. McNeely, secretary-treasurer and director; H. Hise, director; D. D. Sales, director.

c. *Other properties owned or operated.*—The Sears Point toll road owns no other properties than the toll road described above. The holding company, Golden Gate Ferries, Inc., owns and operates ferries from San Francisco to Berkeley and to Sausalito, and also the Monticello Steamship Company, running to Vallejo.

d. *General relation to state and county roads.*—As described in section IV, p. 29, pp. 34–36, of this report, this road serves as a connection between East Bay or Sacramento Valley points and Marin or Sonoma counties. It is shorter than the state highway, particularly for Marin and lower Sonoma county points.

3. Organization of the project.

a. *Early history of the project.*—Persons interested in Vallejo and vicinity were chiefly instrumental in promoting the construction of this road. They brought it to the attention of the Governor's committee in 1925, but its inclusion into the highway system was not recommended by that body. A bill was introduced into the Legislature in 1925 for state aid on this road, which did not pass. No action being taken by the state, it was later taken up with Mr. A. O. Stewart of the Golden Gate Ferries, Inc., who, after much study and consultation with various people and officials of Vallejo and of Solano, Marin and Sonoma counties, approved and undertook the construction of the project. It was completed and opened to traffic, except for the cut-off to the highway north of Vallejo, in July, 1928.

b. *Corporate history and franchises.*—The Sears Point toll road was incorporated under the laws of California on November 23, 1925, with an authorized capital stock of $600,000 par value. The stock was turned over to the Golden Gate Ferries, Inc., who furnished the necessary finances to construct the toll road.

A franchise was obtained from the counties concerned, a copy of which is appended to this report.

Section I, Plate 1*a* shows the general location of this road and bridges, in relation to the surrounding country and approach roads.

4. Financing the project.

a. *Capital stock.*—The authorized capital stock of the Sears Point Toll Road Company consists of 6000 shares, of $100 par value each. All of this stock, except 5 shares which are qualifying shares for the directors of the company, are held by Golden Gate Ferries, Inc., a holding company. The balance sheet of the company, dated September 30, 1928, shows a stock discount of 482,400 shares under deferred assets, leaving only $117,600 par value of capital stock actually out against the value of the property.

b. *Funded debt.*—This is represented by a bond issue of $500,000 known as "Sears Point Toll Road Company, first closed mortgage 7 per cent, 15-year sinking fund, gold bond," said bonds dated June 1, 1926, and mature June 1, 1941. These bonds sold to the Golden Gate Ferries, Inc., against which the holding company issued its own securities, were later sold to the public. There is a bond discount of $44,444.40 included in the book value of property, owned September 30, 1928, and

$847.80 has been amortized during the three months the road was in operation previous to this date.

c. Other sources of income for construction.—Apparently all finances for the construction of this toll road came from the Golden Gate Ferries, Inc., and they received in return an equity in the toll road, represented by all its capital stock and funded debt.

5. Preliminary investigation and design.

a. Investigations of the site, surveys, etc.—A preliminary reconnoissance was made originally by District IV of the State Highway Commission. No detailed record of the final location of the road or the investigation of bridge foundations is at hand.

b. Engineers and comparative studies.—A preliminary survey was made by T. D. Kilkenny, and R. L. Vaughn was supervising engineer. The designs of the steel bascule bridges were studied and plans drawn by the Strauss Engineering Company of Chicago, and passed upon by Mr. Jos. M. Strauss individually.

c. Final design plans and estimated quantities.—The bascule type of bridge was adopted for Sonoma Creek and the Napa River and a timber lift span for Tolay Creek, where its opening would be necessary at very infrequent intervals, if ever. The footings necessarily rest on pile foundations in this swampy country.

The approximate quantities of materials in the bridges and excavations for the 10.2 miles of road already built are as follows:

Bridges	Napa River	Sonoma Creek	Tolay Creek
Timber, untreated, M B.M.	583	278	108
Timber, treated, M B.M.	36	32	5
Piling, treated, lineal feet	31,300	21,600	6,480
Piling, untreated, lineal feet		2,400	
Hardware, pounds	38,000	18,000	14,500
Concrete, dry, cubic yards	285	329	
Concrete, wet, cubic yards	353	181	
Concrete counterweights, cubic yards	137	99	33
Steel, reinforcing, pounds	26,300	22,800	1,960
Steel, structural, pounds	221,000	201,000	10,500
Machinery, etc., pounds	28,000	28,000	15,500
Traffic plates, square feet	780	656	
Crushed rock, cubic yards	45	25	
Asphalt surface 2 inch, square feet	48,900	23,750	2,650
Toll and operating house	1	1	None
Gas engines	1 at 30 HP.	1 at 30 HP.	None
Electric motor	1 at 2 HP.	1 at 2 HP.	None

Road	
Embankment, cubic yards	560,000
Crushed rock and oil surfacing, cubic yards	29,400
Culverts 30 inch C.M.P., lineal feet	368
Right of way, acres	180

6. Construction data.

a. *Contracts awarded and final payments.*

Duncanson & Harrelson:			
Napa River and Sonoma Creek bridges—			
Lump sum contract and extras		$256,691	
Tolay Creek Bridge—			
Lump sum contract and extras		30,561	
Material purchased by company		9,212	
Toll house		1,014	
Total bridges			$297,478
A. S. Dutra, dredging:			
311,159 cy. at 7c	$21,781		
Culverts, 5 at $200	1,000		
Extra work, slopes	1,000		
		$23,781	
Dutton Dredging Co., dredging:			
Lump sum	$16,990		
Rent of equipment and extras	941		
		17,931	
Hass, Doughty & Jones, drag line work:			
Lump sum, estimated on 200,000 cy. at 10c	$20,000		
Culverts and crossings	675		
Extras	92		
		20,767	
Harlan White, grading Sears Point, "Y":			
Lump sum	$3,750		
Filling 1250 cy. at 80c	1,000		
Leveling	447		
		5,197	
Hutchinson Co., finish grading and surfacing:			
Grading	$5,300		
44,144 tons rock in place at 2.14	94,704		
Plowing and rolling embankment, oil macadam surfacing, (95,535 square feet) and mis.	17,782		
		117,786	
Miscellaneous extras		2,014	
Total roadwork			187,476
Total construction as of Sept. 30, 1928			$484,954

b. *Description of construction.*—As stated above, the road is practically all located over tidal marsh and the road embankment made by dredger fill from borrow alongside the road. This required a right of way, for the most part, of 160-foot width. After the fills so constructed had settled into place, finish grading was done to level them up or fill out the slopes, and on this was placed an oil macadam surface which should serve until the embankment has finally settled and a more permanent pavement can be laid.

The bridges rest on pile foundations and there are apparently no unusual features connected with them.

No actual details of the construction work are known other than the contract work listed above and the kind of construction necessary under the conditions.

7. Traffic and income.

a. *Present traffic and income.*—The operating statement of the company shows that $17,468 in tolls was taken in between July 4, 1928, when the road was opened, and September 30, 1928. For the first few

days free passes were given, with invitations to the public to use the road, in order to advertise it. The monthly vehicle traffic to the end of December, 1928, was:

July 4-31	21,352	
August	19,506	
September	18,811	Passengers average
October	13,058	2⅛ per car
November	11,791	
December	9,625	

It is expected that the completion of the cut-off north of Vallejo will stimulate traffic to some extent.

The tolls charged on the road are: Auto and driver, 35 cents; extra passenger, 5 cents; trucks, 45 cents, plus 6 cents per 100 pounds.

Taking 2.1 passengers per auto, an average toll on trucks of $2, and 30 autos to one truck, the average toll per vehicle would be about 46 cents. The estimated traffic for one year based upon the traffic for the months listed above is 168,000 vehicles. This is on the assumption that the traffic for the months shown is 55 per cent of the total yearly traffic, which is approximately the figure obtained from the records of the Richmond-San Rafael and Martinez ferries. 168,000 vehicles at 46 cents gives a present yearly income of approximately $77,000.

b. *Estimated future income.*—Future traffic here again depends first upon general increase in population and use of autos, represented principally by registration figures, and second upon changes in local conditions. The outstanding changes which would tend to increase traffic over this toll road are the construction of the proposed American Canyon cut-off (see Section IV) and the construction of a Golden Gate bridge. The proposed revision of the highway in Marin County should also be helpful. An adverse factor would be the construction of the Richmond-San Rafael Bridge.

The best that can be done at this time is to assume an average increase in traffic based on predicted increases in population and auto registration. The life of the franchise is 50 years, and any prediction of income so far in the future is of little worth, since predictions made for only a matter of three or four years ahead are usually considerably in error. In order to estimate the present worth of future earnings, an assumption that the gross earnings will increase on an average of 3 per cent per year is as reasonable a prediction as present data will allow. It will be noted that the probable error of the assumed earnings toward the end of the franchise life will be greater, but at the same time the effect of the error on present worth will be less than in the case of earlier years.

8. Operation and maintenance.

a. *Administration, advertising and collection of tolls.*—The total amount for three months of operation as shown by the company's operating statement of July 4, 1928, to September 30, 1928, was as follows:

Administration and collection of tolls (head office charge not shown separate)	$4,287 39
Advertising	2,438 32

The cost of administration and collecting tolls on this basis would be about $17,000 per year, which probably will be reduced somewhat, as it includes the extra costs incident to the opening of the road to traffic. An average figure of $16,000 per year is estimated for this item.

The cost of advertising is also likely to be heavier for the first period than afterward, and it is estimated that the average cost should not exceed $6,000 per year, making a total cost under this head of $22,000 per year.

b. *Maintenance and repairs.*—Owing to the nature of the roadbed which has been constructed over swamp land, settlement is probable in places for some time to come. The oil-macadam surfacing under such conditions will require considerable patching and replacement for several years and shoulders and slopes built up. As traffic increases the roadbed will have to be gradually improved, widened and finally paved. The average upkeep is assumed at $800 per mile, or $8,000 per year for the road. An additional cost of $500 per year should provide for bridge maintenance.

c. *Insurance and taxes.*—This amounted to $1,670 for three months, or about $6,500 per year, which figure will be used in estimating average cost of operation.

From the above figures the total estimated annual cost of operation, excepting interest and amortization will, therefore, be:

Operation	$22,000
Maintenance	8,500
Insurance and taxes	6,500
Total	$37,000

9. Interest and amortization.

a. *Interest on funded debt and working capital.*—The $500,000 of bonds issued against the bridge bear 7 per cent interest, neglecting bond discount charged to cost of property, but it is probable that if money is borrowed at the end of that time it will be at a lower rate, particularly if the road was then earning dividends on its stock. However, since the future is a matter of conjecture, the present rate will be used in estimating the average annual cost. The interest on $500,000 at 7 per cent amounts to $35,000 per year. The sinking fund payment to amortize $45,000 of bond discount in 49 years is only $265.

b. *Amortization of cost of bridge.*—A study of the company's balance sheet shows property $740,198, including bond discount, and current assets not provided for in cost of operation, $8,865. Against this are liabilities of $688,119, including the net value of the capital stock as shown. Therefore, to amortize the cost of property should satisfy all fixed liabilities. The annual sinking fund payment to retire $740,198 in 49 years at 4½ per cent is about $4,400, say $4,600, including amortization of stock discount as above. The reserve for depreciation is apparently being set aside by the company on a straight line basis, amounting to about $14,000 per year, which will pay off the cost of the bridge in about 28 years.

10. Present value of investment.

a. The original cost as shown by the balance sheet as of September 30, 1928, is as follows:

Construction (contract work and miscellaneous extras)	$484,954
Engineering (preliminary engineering and supervision)	79,506
Right of way and signs	71,240
Legal costs	12,291
Interest during construction	40,850
Organization and franchises	6,823
Bond discount	44,444
Total cost of toll road	$740,108

b. *Capitalized value of total expected net income.*—Present worth of estimated total gross earnings for 49 years at 6 per cent, based on a present estimated annual gross earning of $77,000 and an average increase of 3 per cent per annum throughout the life of the franchise (see 7 a and b above) is $1,938,000, present worth of annual cost of operation, interest and amortization ($76,600) for 49 years, $1,203,000 and present worth or capitalized value of net earnings, $735,000.

This figure then represents the amount that would have to be invested in 6 per cent securities in order to give the same future income as would the operation of the toll road, assuming, of course, that the estimates of future traffic and operating costs are correct. In addition to this, the owners would require a sum which at 6 per cent interest will return the amount invested in the project over the bonded indebtedness at the end of the franchise life, and that the purchasers will assume the payment of the bonds. The total cost to the purchasers by this method and under the above assumptions (which are about the best that can be made at the present time in order to establish a "going concern" value) is as follows:

Capitalized net earnings, as above	$735,000
Present worth of $500,000 of bonds due in 14 years, assuming no immediate refinancing. Interest at 6 per cent	221,150
Present worth of $240,198 to be amortized in 49 years	13,811
	$969,961

Assuming the project is to be refinanced immediately, the state would have to put up about $525,000 to purchase the bonds, instead of setting aside the $221,150 shown above. This increases the total to about $1,250,000.

c. *Estimated cost of construction by state.*

Cost of construction, road and bridges	$450,000
Engineering and contingencies, 12 per cent	54,000
Right of way (actual)	70,000
Interest on bonds at 4½ per cent	34,000
	$604,000

11. Acquisition and operation of toll road by the state.

a. *Acquisition.*—As computed above, the various values upon which to base the purchase of the toll road are:

Original cost as shown by the books of the company	$740,108
Capitalized value of predicted earnings plus present cost of retirement of bonds and remaining portion of investment when due	$969,961

The estimated cost of construction by the state is $604,000, which is less than the cost to a private corporation, due primarily to lower costs of financing and practically no organization cost.

b. *Operation of road by the state.*—If the state had built the road the cost of operation would be about as follows:

Operation and maintenance, (no taxes or advertising)	$30,000
Interest on $604,000 at 4½ per cent	27,180
Amortization of cost in 48 years (4½ per cent sinking fund)	3,750
Total annual cost	$60,930

If the road could be purchased at its original cost ($740,108), the cost of operation would be $67,900, and on this basis tolls could be reduced to an average of 40 cents for the first year with a steady reduction from then on as traffic increased.

Purchasing the road on the basis of expected future income would not be practical unless it was certain that the average toll could be reduced below its present amount within a few years' time at least.

SAN MATEO–HAYWARD BRIDGE

2. General data and information.

a. *General description of the project.*—The San Mateo-Hayward Bridge is a bridge now under construction across the southerly arm of San Francisco Bay between San Mateo and Hayward. It is privately owned and is to be a toll bridge.

The bridge is a low-level structure approximately seven miles long, and consists of the following:

MAIN BRIDGE.

1,054 spans at 30 feet (reinforced concrete)
116 spans at 35 feet (reinforced concrete)
4 fixed through steel spans at 300 feet
1 steel through lift span at 302 feet

SEAL CREEK.

1 reinforced concrete span at 43 feet
31 reinforced concrete spans at 30 feet

The width of clear roadway between curbs is 28 feet.

The reinforced concrete spans are of the precast type, resting on composite timber and concrete and concrete piles.

The vertical clearance provided above mean high water under the lift span is 35 feet when the lift is down and 135 feet when the lift is fully raised. See Plate X, following.

b. *Name and address of corporation, owners and officials.*—The bridge is owned by the San Francisco Bay Toll Bridge Company, Russ Building, San Francisco, California.

The officials of the company are: Arthur Batty, president; J. A. Beattie, vice president; G. F. Barry, secretary; C. W. McConaughy, assistant secretary and assistant treasurer. Directors: Arthur Batty, San Francisco; Burke Corbet, San Francisco; Horace Brown, San Francisco; A. H. Amphlet, San Mateo; I. B. Parsons, Hayward.

c. *Properties owned and operated.*—The property owned by the San Francisco Bay Toll Bridge Company consists of the San Mateo-

Hayward Bridge now under construction and the approach roads connecting with highways on each side of the bay.

d. *General relation to state and county roads.*—The San Mateo-Hayward Bridge will form a connection between route 5 of the state highway system at Hayward and route 68 of the Bay Shore Highway at San Mateo. The connection on the east side of the bay is approximately opposite the mouth of Dublin Canyon through which route 5 extends easterly to the San Joaquin Valley. This bridge will be a direct connection between two main routes of the state highway system. Referring to Section IV of this report, Plate IV, p. 38, it will be noted that there is approximately 10 miles of county and privately owned road between the east bridge head and route 5 of the state highway system. On the west the road constructed by the Toll Bridge Company connects directly with route 68 of the state highway system.

3. Creation and organization of project.

a. *Early history of project.*—The early conception of this project seems to have been in the original application for a franchise to build a toll bridge at this location by Town, Noon & Deuel, in July, 1927. The franchise was granted to these applicants July 11, 1927, who later transferred the same to the San Francisco Bay Toll Bridge Company. See Plate XI, following, for general location.

b. *Corporate history.*—The San Francisco Bay Toll Bridge Company was incorporated under the laws of Delaware on September 22, 1927, with a capital stock consisting of 2,500,000 shares of 8 per cent cumulative preferred stock and 175,000 shares of common stock, no par value, for the purpose of erecting, operating and maintaining a toll bridge across San Francisco Bay.

c. *Franchise obtained.*—The franchise for this bridge was granted by San Mateo County and extends to July 11, 1977, a period of 50 years. A copy of this franchise is appended to this report.

4. Financing the project.

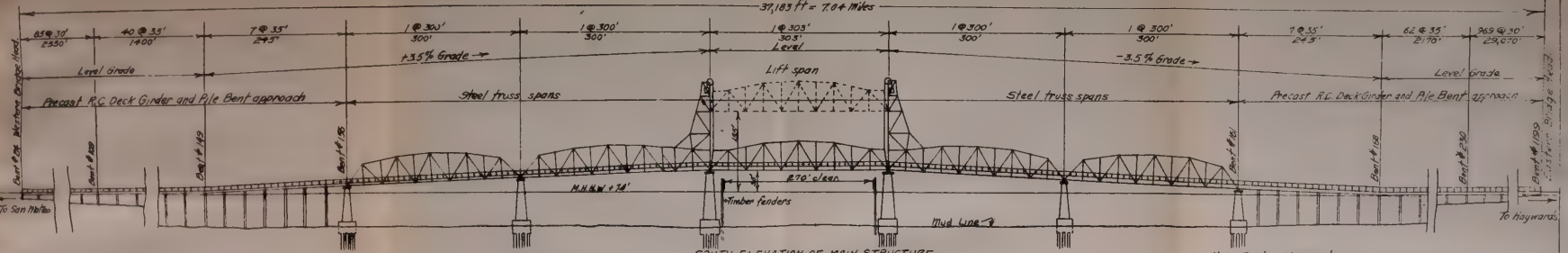
a. *Sale of stock.*—Of the $2,500,000 of preferred stock authorized, a permit dated November, 1927, grants the right to sell 10,000 shares at $100 per share, to net the company not less than $90 per share.

The records of the Corporation Commission show the following distribution of preferred stock:

Arthur Batty, president	$15,000 00
To attorneys	30,000 00
To engineers	20,000 00
To franchise holders	85,000 00
To contractors	580,500 00
Total outstanding	$730,500 00

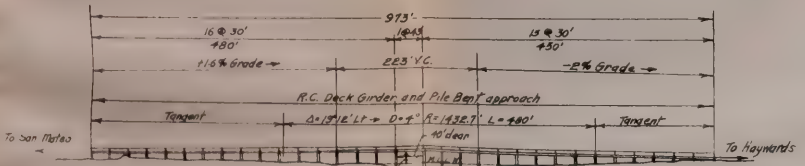
It is understood that the 15,000 to Arthur Batty was sold for cash and the remainder given for services as shown.

The remaining preferred stock authorized but not issued amounts to $269,500. This amount of preferred stock has been underwritten for sale with the understanding that not to exceed the total amount of $1,000,000 will be sold.



SOUTH ELEVATION OF MAIN STRUCTURE
SCALE 1" = 100'

Main Bridge Alignment
Tangent - Bent # 24 to Bent # 239 +
Curve - Δ = 28°21' Rt. D = 5°0'
Tangent - Bent # 253 + to Bent # 1199



SOUTH ELEVATION OF SEAL CREEK BRIDGE
SCALE 1" = 100'

Roadway
All roadway is 27'0" clear, between inside of curbs.
Vertical clearance is 16'-0" at the steel truss portals.

Plate X

INVESTIGATION OF TOLL BRIDGES

GENERAL PLAN OF BRIDGE
OVER
SAN FRANCISCO BAY
BETWEEN
LITTLE COYOTE POINT - SAN MATEO CO
AND
MT. EDEN - ALAMEDA CO
SCALE AS SHOWN

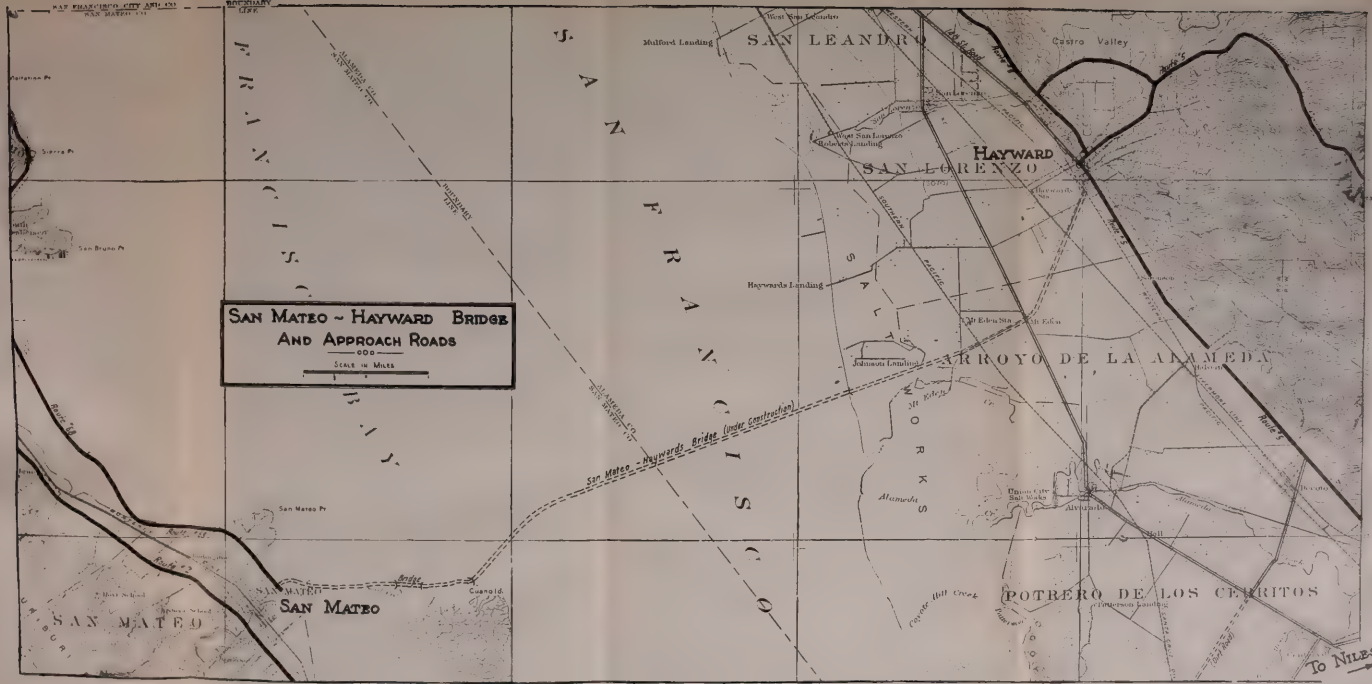


Plate XI—between 84 and 85

The records also show that the permit was granted to issue 120,000 shares of common stock (no par value) to the applicants for the franchise subject to conditions stated in the application for the permit. Later records indicated that the final disposition of this stock was to be as follows:

70 per cent to the underwriters of bonds.
10 per cent to contractor.
20 per cent to parties obtaining the franchise.

b. *Funded debt, amount, rates of interest, description of how and from whom borrowed.*—The funded debt of the company consists of the following:

Four million five hundred thousand dollars of 6½ per cent sinking fund bonds, dated November 1, 1927, to mature November 1, 1957. These bonds are a first mortgage on all the property now owned or to be acquired by the San Francisco Bay Toll Bridge Company and are callable up to November 1, 1937, at 1.05, thereafter to and including November 1, 1947, at 1.03, and thereafter at 1.01. Income tax of 2 per cent to be paid in addition to interest.

Two million dollars of 7 per cent participating sinking fund debentures, dated November 1, 1927, to mature November 1, 1942. Callable to November 1, 1933, at 120, thereafter to and including November 1, 1938, at 115, and thereafter to maturity at 110 and accrued interest.

These bonds have been underwritten by Shingle, Brown Co., Paine, Webber & Co., M. H. Lewis & Co. and Banks, Huntley & Co. The first mortgage bonds were underwritten by the firms of Dillon, Read & Co., Kissel, Kinnicutt & Co., Paine, Webber & Co., Shingle, Brown & Co., M. H. Lewis & Co., and Banks, Huntley & Co.

Bond discount and expenses on September 30, 1928, in connection with these issues was $667,172, or slightly more than 10 per cent.

The cost of this loan to the bridge company is:

Interest on bonds	$432,500 00
Bond discount, expenses and amortization at 4¼ per cent	17,450 00
Total	$449,950 00

This annual cost on $5,832,828 represents an interest charge, 7.7 per cent on the cash received for the bonds.

5. Preliminary investigation and design.

a. *Investigation of site, surveys and borings.*—The preliminary investigations were made by the Raymond Concrete Pile Company.

b. *Design and adopted layout with estimated quantities.*—The design studies and design were made by the Raymond Concrete Pile Company and approved by Waddell and Hardesty, a firm of consulting engineers of New York. The lift span was designed by Waddell and Hardesty. A. W. Deuel is resident engineer for the bridge company.

The final plan lay-out is given under 2a, General Description of Project, Plate XI.

The estimated quantities of material entering into the structures are as follows:

Concrete:

Decks, caps and keys	60,500 cu. yds.
Curbs, rails and posts	4,025 cu. yds.
Pier bases	4,065 cu. yds.
Pier shafts	2,765 cu. yds.
Counterweights	540 cu. yds.
Slab on steel spans	1,010 cu. yds.
Concrete piling	328,890 lin. ft.

Timber:

Treated timber piling	43,240 lin. ft.
Treated timber in fenders	47 M B.M.
Untreated timber in caissons	357 M B.M.

Steel:

Reinforcing steel	13,504,000 lbs.
Structural steel (expansion angles)	125,000 lbs.
2 fixed spans	1,700,000 lbs.
2 fixed spans (with towers)	2,720,000 lbs.
1 lift span	1,180,000 lbs.
Sheaves, shafting and bearings	200,000 lbs.
Wire ropes and sockets	80,000 lbs.
Guides, buffers, etc.	30,000 lbs.
Operating machinery	85,000 lbs.
2—210 hp. gas engines	
2— 5 hp. gas engines	
2—Speed reducers	

c. *Design loads and unit stresses.*—The design of this structure is based on American Association of State Highway Officials "Class A" for three 9-foot lines of traffic. The loading is approved for state highway bridges not within or immediately adjacent to cities. It is probable the state would use a Class AA loading for 20-ton trucks on account of the close proximity to San Francisco, if designed by the state. The vertical portal clearance is 16 feet. This is approved for state highway clearance. Plate No. X shows the general layout. p. 84.

6. Construction data.

a. *Contracts awarded.*—As before stated, the contractor on this bridge is the Raymond Concrete Pile Company, as general contractor.

The Olympian Dredging Company has the contract for dredging. The Dutton Dredge Company has the contract for approaches, and the Foundation Company of New York, the contract for the construction of piers.

The work of constructing the bridge has been carried on in a commendable and efficient manner, with the result that apparently a very well constructed structure has been built.

During the construction of the piers, one of the caissons failed, causing considerable extra expense to the foundation contractor. Several unique methods have been employed in the construction of this bridge, and, while none of them are new, they have no doubt enabled the contractors to erect portions of the structure quickly.

The reader is referred to articles in the Western Construction News issues of April 10, 1928, and September 25, 1928, for details of construction. Briefly, the outstanding feature of construction was the use of precast concrete floor slab for the long reinforced concrete approaches. This method enabled the consolidation of concrete pouring operations to a central plant, and made the use of false work unnecessary.

The general contract for the bridge was let on a lump sum cost basis, plus 10 per cent, to the Raymond Concrete Pile Company.

The contractor guarantees a maximum cost of $5,000,000 plus 10 per cent.

The contract provides that the Toll Bridge Company shall not be required to pay extra if foundation conditions are more expensive than the plans call for.

If the cost is less than $5,000,000, the bridge company is to pay one-half of saving to the contractor.

A time bonus, penalty clause is included in the contract to the effect that if the contractor completes the bridge prior to the specified time of completion he shall receive $1,200 per day bonus; and if more time is required than the specified time, he shall pay the bridge company a sum of $1,200 per day.

For promotion and organization, in addition to the contract price, 5567 shares of preferred stock and 22,268 shares of common stock were issued to the Raymond Concrete Pile Company. Value of the preferred stock is fixed at $100. The value of the common stock (based on the schedule of income predicted by the Toll Bridge Company and computed on a reinvestment rate of 6 per cent) shows a present worth in 1930 of $79.50 per share. If computed on a reinvestment rate of 8 per cent, a present worth in 1930 is $54.60.

Based on the state's estimate of traffic, these values become on 6 per cent, $52.80, and on an 8 per cent basis, $33.

b. *Construction of substructure.*—The substructure for the concrete trestle was of two types. One known as composite timber and concrete pile, and the other, straight concrete piles. The piles were driven from a floating driver having four leads.

The substructure for the steel spans is of the ordinary type of concrete pier, resting on piles driven to firm foundation.

The open caisson method of sinking was used.

c. *Construction of superstructure.*—The steel spans of the superstructure are being erected on shore and floated into place on barges, advantage being taken of the rise and fall of the tide.

d. *Miscellaneous work.*—Road approaches consist of 250,000 cubic yards of road excavation and 24,235 linear feet of 27-foot width pavement, having a thickness of 8 inches at the center.

7. Traffic and income.

Inasmuch as this bridge is not yet in operation, no data is available upon which to base income, except by estimating traffic. A traffic estimate has been made by the engineers and officers of the San Francisco Bay Toll Bridge Company, as follows:

Annual traffic during first year of operation:	
Pleasure cars	1,322,562
Commercial traffic	150,967
Estimated toll per pleasure car	$0 60
Estimated toll per commercial car	1 75
Estimated income—	
Pleasure cars	$793,537 00
Commercial cars	264,192 00
Total	$1,057,729 00

No prediction as to future traffic has been made by the bridge company. Any estimate that can be made is at best very approximate. It is probably conservative to estimate an average annual increase of 3 per cent to 1950, and 2 per cent from 1950 to 1977 when the franchise will expire.

A table indicating estimated income on this bridge at 5-year periods, providing the toll rates remain unchanged, is as follows:

Year	Income pleasure cars	Income commercial cars	Total income at $0.60 and and $1.75, respectively
1930	$793,537	$264,192	$1,057,729
1935	918,000	306,000	1,224,000
1940	1,065,000	355,500	1,420,000
1945	1,235,000	410,000	1,645,000
1950	1,432,000	477,000	1,909,000
1955	1,580,000	525,000	2,105,000
1960	1,745,000	576,000	2,321,000
1965	1,927,000	640,000	2,567,000
1970	2,130,000	707,500	2,837,500
1975	2,355,000	782,000	3,137,000
1977	2,440,000	810,000	3,250,000

8. Operation and maintenance.

The San Francisco Bay Toll Bridge Company has estimated that their yearly cost of operation will be as follows:

Operating expense, maintenance and tax	$189,260 00
Interest on 6½ per cent bonds	292,500 00
Interest on 7 per cent bonds	140,000 00
Amortization, federal income tax and preferred stock dividend requirements	274,012 00
Total yearly cost of operation	$895,772 00
3 per cent participation by 7 per cent bonds	60,000 00
Total	$955,772 00

9. Probable dividends, common stock.

From these figures it is seen that the estimate of net earnings the first year of operation amounts to $101,957 available for dividends on 120,000 outstanding shares of common stock, or 85 cents per share.

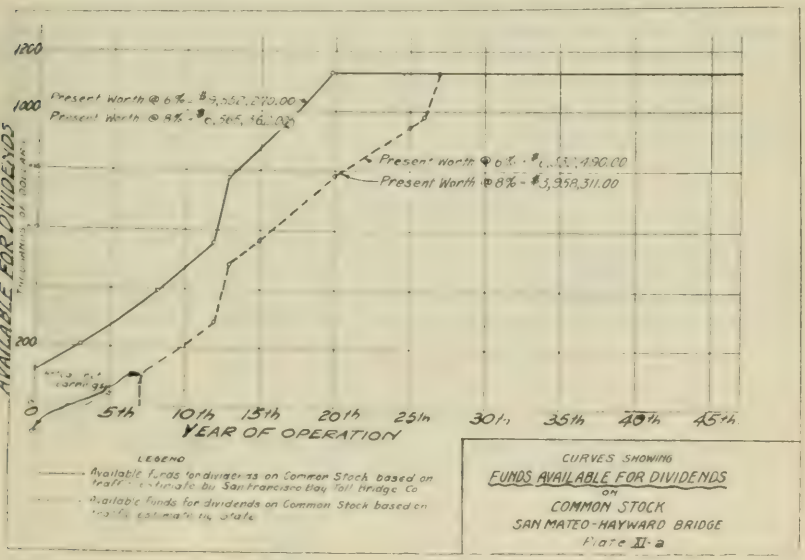
By 1935 the amount available for dividends on the common stock will have increased to $268,228, or approximately $2.20 per share; in 1940, $464,228, or $3.87 per share. In 1943, when the 7 per cent debentures have been amortized and paid, the operating expense will be reduced by a sum of $176,600. The yearly cost of operation will then be reduced to $779,172.

The gross income in 1943 will be $1,550,000, and the net return available for dividends on the common stock, $770,828, or $6.43 per share.

Assuming that the total cost of the bridge to the bridge company will be $7,500,000, the money available for dividends will increase until the net return is 15 per cent of the original cost of the project ($7,500,000), or $1,125,000. This stage will be reached in 1950. After 1950, unless by some means the company can show a higher cost than $7,500,000, the dividends will, under the law which limits earnings to 15 per cent, remain at $9.36 per share on 120,000 shares of common

stock. This assumes, of course, that no more common stock will be issued. After 1950 it is, therefore, probable that the present existing tolls will have to be lowered to comply with the law. It is also possible for the bridge company, by refinancing, to reduce their operating expenses still more and thereby arrive at the 15 per cent earning stage before 1950, and raise the present worth of the common stock.

These figures on traffic, income and dividends are based on the estimates of the San Francisco Bay Toll Bridge Company. From a study of Section IV of this report it is estimated that the traffic using this bridge during the first year of operation will yield an income of approximately $650,000 for pleasure cars and $210,000 for commercial vehicles, computed on the same toll basis and figuring that the added convenience of a bridge will increase the apparent available traffic by 50 per cent. This estimate for the first year gives a total gross income of $860,000 as against $1,057,000 estimated by the company.



Applying the same rate of yearly increase of traffic; viz. 3 per cent to 1950 and then 2 per cent yearly increase, it will be noted (See Plate XI-a) that no funds will be available for common stock dividends until 1937, and the time at which the maximum earning is reached will be deferred until about 1958. Refer to Plate XI-a for comparative dividend curves.

10. Present value of investment.

The following values assumed to be applicable on the completion of the bridge:

a. *Original cost.*—The original cost of the bridge to the San Francisco Bay Toll Bridge Company is estimated by the bridge company as follows:

Cost of construction, structures and approaches	$5,500,000 00
Right of way	100,000 00
Organization, legal and corporation expense	154,060 00
Discount on securities	746,000 00
Interest during construction	527,650 00
Engineering and supervision	195,000 00
Contingencies	277,290 00
	$7,500,000 00

b. *Estimated cost of construction of bridge by the state.*—If financed on the basis of 6 per cent income bonds and designed by the state and constructed on a competitive bidding basis, the cost of construction and operation is as follows:

Cost of construction by state:

Preliminary surveys and borings	$25,000 00
Bridges and approaches	4,900,000 00
Right of way	60,000 00
Legal expense	100,000 00
Interest during construction	420,000 00
Engineering and contingencies, 9 per cent	441,000 00
	$5,946,000 00

Cost of operation by state

Administration and overhead	$30,000 00
Collection of tolls and operation	50,000 00
Maintenance and repair	8,000 00
Interest on bonds ($5,950,000 at 6 per cent)	357,000 00
Amortization bonds over 50 years at 4 per cent over 47 years	44,700 00
Insurance	28,000 00
	$517,700 00
Say	$520,000 00

TABLE ESTIMATED TRAFFIC, INCOME AND REQUIRED TOLLS STATE CONSTRUCTION AND OPERATION

Year	*Pleasure cars*	*Commercial cars*	*Operating expense*	*Toll for pleasure cars*	*Toll for trucks*
1930	1,300,000	150,000	520,000	.28	1.10
1935	1,505,000	174,000	520,000	.24	.94
1940	1,740,000	209,000	520,000	.20	.81
1945	2,025,000	234,000	520,000	.18	.70
1950	2,345,000	271,000	520,000	.15	.61
1955	2,590,000	299,000	540,000	.14	.57
1960	2,860,000	340,000	540,000	.13	.51
1965	3,160,000	355,000	540,000	.12	.47
1970	3,490,000	402,500	540,000	.11	.42
1975	3,860,000	445,000	540,000	.10	.38
Avg.	24,875,000	2,859,500	5,300,000	.15	.58

Comparing the tolls which would have been necessary had the bridge been financed by 6 per cent income bonds and constructed and operated by the state, with the tolls which are to be charged by the bridge company, we arrive at the following comparative figures:

Average toll under state operation, 1930 to 1977

Pleasure cars	15 cents (average)
Commercial cars	58 cents (average)

Tolls under private ownership, 1930 to 1950

Pleasure cars	$0 60
Commercial cars	1 75

1950 to 1957
(Return limited to 15 per cent by law on $7,500,000)

Pleasure cars	$0 56 (average)
Commercial cars	1 66 (average)

1957 to 1977
(Return limited to 15 per cent on $7,500,000)

Pleasure cars	$0 38
Commercial cars	1 13

c. *Capitalized value of total expected net earnings. Value to common stockholders.*—If the estimated net earnings based on the first year traffic prediction of the San Francisco Bay Toll Bridge Company, be capitalized at 6 per cent for the life of the franchise, and the present worth of these earnings computed, we find that the present worth of these predicted earnings on the common stock is $9,552,269.70.

This figure means that if the common stock is to be purchased at this time and the holders of the stock are to reinvest the money so obtained at 6 per cent interest in such a way as to obtain income equal to the predicted income from the bridge, they will have to be paid the sum of $9,552,269.70, or approximately $79.50 per share for the 120,000 shares of common stock outstanding.

In addition to the common stock there is $4,500,000 in 6½ per cent bonds callable at 105; $2,000,000 in 7 per cent bonds with an additional 3 per cent participation in net earnings clause, callable at 120, and $1,000,000 in preferred stock.

If the state or county should desire to purchase the bridge and the value was fixed on a basis of present worth to the toll bridge company, the following capital investment would be necessary:

Purchase of common stock, 120,000 shares	$9,552,270 00
First mortgage bonds, 45,000 at 1.05	4,725,000 00
Second mortgage bonds, 20,000 at 1.20	2,400,000 00
Preferred stock	1,000,000 00
	$17,677,270 00

If the common stock holders are willing, or if the board of arbitration decides in determining the purchase price that the money received for common stock can be reinvested at 8 per cent, then the present value of the common stock is reduced to approximately $54.60 per share, and the corresponding purchase price would be $6,565,362. The total capital investment required then becomes $14,690,362 instead of $17,677,270. These figures are given to show the variation in value to common stock holders, due to a variation in justified reinvestment rate.

Whether or not the investment in the bridge is one in which the degree of risk demands a 6 per cent, 7 per cent or 8 per cent rate of interest is a question which must be decided before the present worth of the bridge to the common stock holders can be determined.

If the net earnings as predicted by a conservative study of present existing traffic by this department be capitalized at 6 per cent for the life of the franchise, we find the present worth of the common stock is $6,332,490.

TRAFFIC INCOME ESTIMATED BY STATE

Year	Income pleasure cars	Income commercial cars	Total income	Net income
1930	$650,000	$210,000	$860,000	$95,800
1935	753,000	243,000	996,000	40,200
1940	875,000	282,000	1,157,000	201,200
1945	1,010,000	327,000	1,337,000	558,000
1950	1,175,000	379,000	1,554,000	775,000
1955	1,300,000	418,000	1,718,000	939,000
1960	1,430,000	462,000	1,892,000	1,125,000
1965	1,580,000	510,000	2,090,000	1,125,000
1970	1,745,000	563,000	2,308,000	1,125,000
1975	1,930,000	622,000	2,552,000	1,125,000
1977	2,050,000	646,000	2,696,000	1,125,000

If an 8 per cent rate is applied to the reinvested return from common stock, then the present worth becomes $3,958,311.

From the figures given it is seen that the three methods employed to figure value are as follows:

Cost of construction to company	$7,500,000 00
Cost of construction by state	5,946,000 00
Present worth to common stockholders on prospective income basis (Based on San Francisco Bay Toll Bridge Company's traffic prediction) 6 per cent reinvestment rate	$17,677,270 00
8 per cent reinvestment rate	14,690,362 00
Present worth to common stockholders; income basis (Based on traffic predicted by the state)	
6 per cent reinvestment rate	$14,457,490 00
8 per cent reinvestment rate	12,083,311 00

These figures are given to show the relative effect of different assumptions as to a fair interest return on a toll bridge investment on its value to stockholders.

11. Summary and discussion of acquiring and operating by the state.

a. *Methods of acquiring.*—The San Mateo-Hayward Bridge is not now on the highway system though it is to be a very important connecting link between routes 5 and 68. To acquire this bridge the state would first set up necessary legal machinery to provide for its acquisition. It is assumed that the state has been given, at the time of purchase, the right to finance and purchase private toll bridges by issuing income bonds. Having declared the acquisition of this bridge a public necessity the state might first open negotiations with the toll bridge company to purchase. Failing to agree on a proper purchase price, the necessary action would have to be taken to acquire the bridge by condemnation or otherwise. In considering the purchase of this bridge attention is drawn to the following clause in the franchise granted by San Mateo County to the Dumbarton Bridge Company, prior to the construction of the San Mateo-Hayward Bridge.

"Section 8. During the period of fifty (50) years from and after the effective date of this ordinance, the county of San Mateo will not erect, construct, own, hold, operate nor maintain from any part or place in said county of San Mateo across San Francisco Bay, without first purchasing, in the manner provided by Section 2881 of the Political Code of the State of California, the toll bridge to be erected and constructed by the franchise granted herein."

b. *Summary of values on which to base purchase price.*—Three general methods of computing value have been shown as follows:

1.—Cost of construction to the San Francisco Bay Toll Bridge Company	$7,500,000
2.—Cost of reproduction by the State of California (financed by 6 per cent income bonds)	5,946,000
3.—Present worth based on predicted income:	
a.—Based on income predicted by the San Francisco Bay Toll Bridge Company	
Computed on the basis that 6 per cent is an equitable rate on which the stockholders can reinvest funds	17,677,270
Computed on the basis that 6 per cent is an equitable rate on reinvested funds	14,690,362
b.—Based on income predicted by this department—	
On 6 per cent reinvestment basis	14,457,490
On 8 per cent reinvestment basis	12,083,311

c. *Method of financing by the state.*—The method of financing proposed is by issuing income bonds secured by income from tolls as outlined hereinbefore.

DUMBARTON BRIDGE

2. General data and information.

a. *General description of the project.*—The Dumbarton Bridge is reached from the west by county roads leading out from Redwood City and Palo Alto and on the east the approach to the bridge is through Newark and Centerville. The state highway, route 2, passes through Redwood City and Palo Alto and runs into San Francisco via Colma. At Centerville there are two county highways, one running north through Alvarado to San Leandro and the other to Niles on the state highway, route 5, opposite the mouth of Niles Canyon. In order to connect with the county highways described the bridge company built 5.4 miles of road with a 24 foot width of oil-macadam surfacing across the tidal lands at both ends of the bridge. Until the San Mateo-Hayward Bridge is completed, the Dumbarton Bridge is the only means of crossing San Francisco Bay by a bridge and it directly serves traffic coming through Niles Canyon from the interior which is bound for the San Francisco peninsula.

The bridge itself consists of eight 225-foot through steel truss spans, one 228-foot steel lift span and 4300 lineal feet of concrete and steel trestle approach. The width of roadway is 24 feet between curbs. The clearance above highwater for the lift span in its raised position is 135 feet. Plate XII, which follows, shows the general dimensions of the bridge and Plate XIII, following subsection 3a, page 95, the general location.

b. *Name and address of owning company and officials.*—The bridge is owned by the Dumbarton Bridge Company, located at 721 Crocker Building, San Francisco. The officers of the company are:

J. B. McCargar, president; R. S. Shainwald, vice president; E. H. Wiel, vice president; Crocker National Bank, treasurer; H. N. Baker, secretary. Directors: W. W. Crocker, San Francisco; E. H. Wiel, San Francisco; J. B. McCargar, San Francisco; R. S. Shainwald, San Francisco; J. G. Sutton, San Francisco; G. R. Walter, San Francisco; J. L. Harrington, Kansas City; G. T. Cameron, San Francisco; Herman Phleger, San Francisco.

c. *Other properties owned.*—This company owns no other properties operated for income. Their office is also the headquarters for the California-Arizona Bridge Company, owners of the Ehrenburg Bridge, and many of the officials of the Dumbarton Bridge Company are affiliated with the other company.

3. Organization of the project.

a. *Early history.*—A corporation known as the Dumbarton Highway Bridge Corporation was incorporated under the laws of California in 1923 for the purpose of constructing a bridge at the same location, but it was unable to complete the financing and no work was done. In consequence its franchise was forfeited. This corporation sold $172,700 par value of its capital stock to the public to net itself 80 per cent of par value or $138,160. The Dumbarton Bridge Company was then formed by a group of San Francisco business men for the purpose of constructing the bridge and a new franchise was granted to J. L. Harrington by San Mateo County, November 20, 1924. Plate XIII, which follows, shows the layout of the bridge and its approach roads.

b. *Corporate history.*—The Dumbarton Bridge Company was incorporated under the laws of California, November 21, 1924, with an authorized capital stock of 250,000 shares at $10 par value each. The purpose was the construction of a bridge over the lower portion of San Francisco Bay between points designated in the application.

The new company agreed either to issue its own stock at $5 per share in return for the amounts paid in by the stockholders of the old corporation or to refund them 80 per cent of the amounts in cash.

Permits to issue a total of 239,181 shares of its capital stock have been granted by the Corporation Commission, the stock to be given for services or for cash, at a price of $5 per share to net the company the same amount.

c. *Franchises obtained.*—A franchise for 50 years was granted by San Mateo County to John Lyle Harrington for the purpose of operating a toll bridge across San Francisco Bay. The franchise was later assigned to the Dumbarton Bridge Company. A provision of the franchise states that the county cannot own or operate a bridge across the bay during the life of the franchise without first purchasing this bridge in the manner prescribed by law. A copy of the franchise is appended to the report.

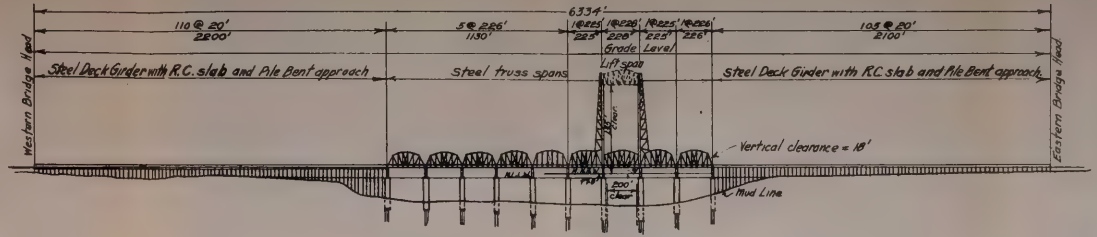
4. Financing the project.

a. *Capital stock.*—The capital stock of the company consists of 250,000 shares of common stock authorized, and 239,167 shares outstanding. The records of the corporation commission show permits granted for the following amounts of stock:

14	shares issued to the incorporators
180,000	shares to be sold at $5.00 per share to net $5.00
25,000	shares to go to J. L. Harrington for services
34,167	shares to be sold to certain stockholders at $5.00 per share to net $5.00
239,181	

The issue of the stock is protected by escrow provisions.

b. *Funded debt.*—Nine hundred thousand dollars par value, first mortgage, 6½ per cent serial gold bonds were issued in 1925 at 98½. They were underwritten to net the company 93½. The total bond dis-

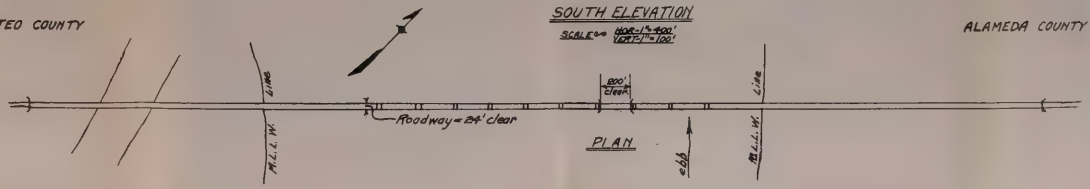


SOUTH ELEVATION

SCALE: HOR: 1" = 400'
VERT: 1" = 100'

SAN MATEO COUNTY

ALAMEDA COUNTY



PLAN

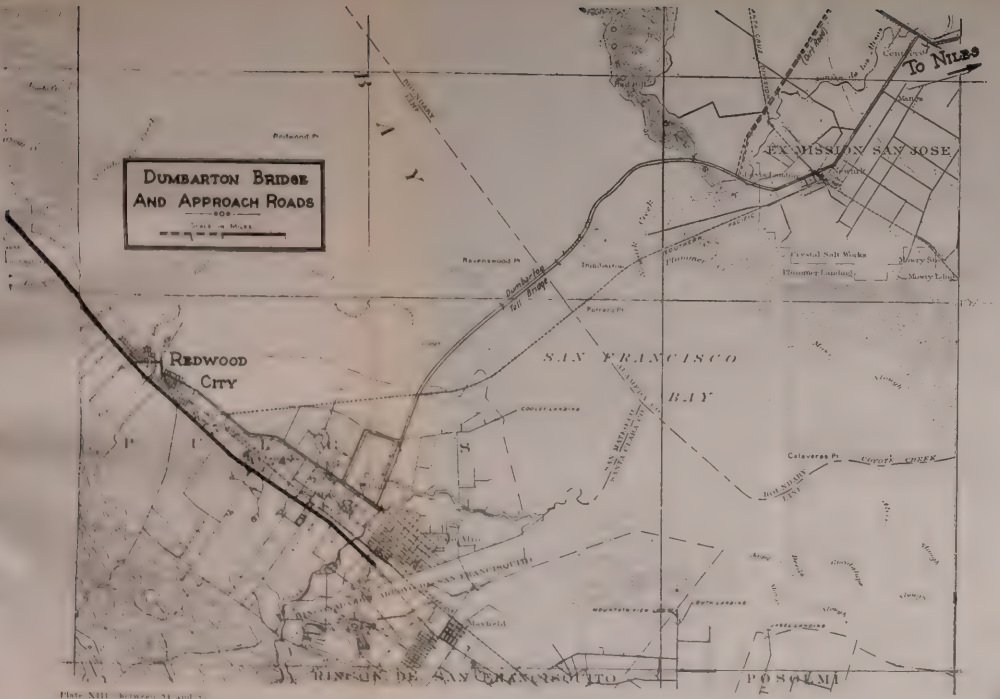
Plate XII

INVESTIGATION OF TOLL BRIDGES

GENERAL PLAN OF BRIDGE OVER SAN FRANCISCO BAY AT DUMBARTON STRAIT

SCALE AS SHOWN

Jan. 1929.


DUMBARTON BRIDGE
AND APPROACH ROADS
SCALE OF MILES
To NILES
EX MISSION SAN JOSE
Dumbarton Point
Ravenswood Pt
Dumbarton Rail Bridge
Dumbarton Toll Bridge
Crystal Salt Works
Mowry Slough
Mowry Landing
Mowry Lding
REDWOOD CITY
SAN FRANCISCO BAY
Calaveras Pt
CORNEY CREEK
Bird Island
Mayfield
Plate XIII between 91 and 92

count and expenses as shown by the books of the company amounts to $65,263.97 and is allocated as follows:

Charged to construction	$10,118.59
Charged to operations in 1927	5,152.00
Shown as a deferred asset, 12–31–27	49,993.38

The net amount of cash received from the sale of bonds was, therefore, $834,736.03 and the actual rate of interest paid about 7.3 per cent on the cash received.

The bonds mature to the amount of $25,000 per year, 1930 to 1933 inclusive, and $50,000 per year, 1931 to 1949 inclusive. They are callable at any time at 105 and accrued interest.

c. *Other sources of income for construction.*—A study of the balance and income sheets of the company indicates that in addition to the receipts from bonds and stock sales about $84,000 has been invested in the property. This amount has been raised through notes and reinvestment of earnings.

5. Preliminary investigation and design.

a. *Investigation of the site.*—No definite information has been obtained regarding the preliminary investigations. The books of the company show that $5,000 was paid to Healy-Tibbits Construction Company contractors, on the foundation work, for driving test piles and making wash borings.

b. *Engineers.*—The bridge was built according to the designs of Harrington, Howard and Ash, for whom Frank M. Cortelyou was the resident engineer in charge of construction.

c. *Final design, plans and quantities.*—The plans adopted were for a structure supported upon pile foundations. Across the deeper portion of the bay there are steel truss spans on concrete piers which are supported by timber piling. The remainder of the structure is a trestle with concrete piles, steel stringers and concrete floor slab, the steel stringers supporting the forms for the floor and making the driving of pile falsework unnecessary.

There are about 2270 tons of steel in the truss spans and towers, 92 tons of machinery and rigging and 287 cubic yards of concrete in the counterweights. There are 9271 cubic yards of concrete in the pier bases, 2006 cubic yards in the shafts and 20,537 lineal feet of foundation piling measured below the base of the piers. In the 4300 lineal feet of approach trestle there are 912 tons of steel stringers.

6. Construction data.

a. *Contracts awarded.*—The Moore Drydock Company, of Oakland, was the contractor on the steel work and the Healy-Tibbits Construction Company of San Francisco on the piers, concrete pile trestle and deck. Other contractors were employed on smaller contracts involving dredging, grading and surfacing approach roads and other miscellaneous work.

The books of the company show the following construction costs:

Steel work	$459,859
Piers	356,338
Concrete piling	155,280
Concrete caps, diaphragms	144,094
Dredging and grading	137,332
Paving (bridge)	106,556
Excavation	72,096
Reinforcing steel	39,954
Riprap, around piers and ends	22,955
Construction and maintenance of dredged channel	20,306
Culverts	20,662
Wood piling	20,595
Fences	30,109
Paving bridge	15,939
Resurfacing road	27,767
Road construction	22,751
Painting	8,005
Motive power, lighting, toll houses and fenders	15,941
Miscellaneous incidental items	6,658
	$1,683,258

b. *Construction of substructure.*—The piers are of concrete supported upon piles and consist of two sections, the upper or shaft section about 31 feet high of the dumb-bell type and the rectangular base section of varying heights up to 43 feet. Timber cribs were sunk, excavated and the foundation piles driven inside them to about 40-foot penetration. A concrete seal was then placed by means of a tremie up to a point about 20 feet below low water, after which the crib was unwatered and the rest of the pier placed in the dry. The lower portion of the crib was left in place. This data was taken from a staff article in the Engineering News-Record, November 25, 1926.

c. *Construction of superstructure.*—The same article describes the erection of the steel truss spans which were erected on the shore and floated into place on barges.

The construction of the approach presents no unusual features. Concrete piles were driven and capped, the stringers placed on the caps and the floor slab placed on forms supported by the stringers.

7. Traffic and income.

a. *Present traffic and income.*—Reference is made to the table in Section IV, p. 39, showing transbay vehicle traffic for July, 1928, its origin, destination and route across San Francisco Bay, one route being via the Dumbarton Bridge. The present yearly traffic over the bridge is on the order of 400,000 vehicles per year and, as the table shows, about 67 per cent of this traffic is between the east bay districts and points on the peninsula south of San Carlos which include Redwood City and Palo Alto. The income from tolls in 1927 was $159,854 according to the income statement of the company, but as permission was granted them to increase tolls in 1928 the indications are that the income for 1928 will exceed that of 1927 considerably. The detailed traffic figures to date have not been obtained as it is thought they have little bearing on the estimated future traffic for reasons to be stated.

b. *Estimated future income.*—It seems evident that the opening to traffic of the San Mateo-Hayward Bridge will have an important effect

upon traffic over the Dumbarton Bridge. The amount of traffic now using the Dumbarton Bridge which will be diverted to the new bridge can only be conjectured. Some idea of the possibilities in this respect may be had from a study of the origin-destination figures for traffic now crossing the bridge. It is quite likely that the new bridge will divert the major portion of the traffic between points north of Niles on the east side and points north of Belmont on the west side of the bay, which now crosses via the Dumbarton Bridge amounting to possibly 30 per cent of its present traffic. If its approach roads are maintained and improved to provide something like the same ease and comfort of travel as the other bridge approaches, the travel to and from points south of San Carlos should continue to use the Dumbarton Bridge. It has been argued that the general stimulation to travel through the opening of a new bridge and the preference of many travelers to go one route and return another, will add as much traffic as the new bridge will take away.

The predicted increase in traffic during the life of the franchise can only be assumed to be the natural increase due to the growth of the communities served and the general increase in auto traffic.

8. Operation and maintenance.

a. *General and administrative.*—This item which includes head office salaries and expenses, legal and advertising costs, amounted to $16,260 in 1927. (See condensed operating statement, p. 99.) The cost of advertising was about $10,500, which is high and is probably due to the extensive work of signing the approach roads to the bridge which, owing to their lack of continuity were hard to follow. It is probable that the cost of advertising can be reduced by half, as an average for future years, making the total for general and administrative around $11,000.

b. *Collection of tolls.*—The total for 1927 covering items which seem to come under this heading was $17,914. No material change in this figure would be expected in future years under conditions similar to the present.

c. *Maintenance and repairs.*—The 5.4 miles of approach roads built as a part of the bridge project are constructed by filling over the tidelands and surfacing the embankment with oiled gravel. There has been considerable settling and sloughing of the fill which should decrease as it becomes compacted. It is thought that the maintenance of the roads will cost about $500 per mile per year as an average.

The cost of repairs and renewals on the bridge itself will be mainly for painting the steel and the renewal of fenders. The average annual cost is estimated to be $3,500.

d. *Insurance and taxes.*—These are shown on the 1927 income sheet as amounting to $11,112.77.

9. Interest and amortization.

a. *Interest on funded debt and working capital.*—Annual interest on the $900,000 par value, 6½ per cent bonds amounts to $58,500 and besides this there would be interest on the $84,000 of other funds given in 4c, p. 95. Figuring the same rate of interest on this amount as on

the bonds as an approximation only, the total annual interest is $64,960. It is assumed in figuring future operating costs that this same rate of interest will continue throughout the life of the franchise.

In addition to the interest an annual sinking fund payment must be provided which will retire the full amount of borrowed capital. Although the bonds mature beginning in 1930 and are finally retired in 1949, it is proper for purposes of estimating the net returns throughout the life of the franchise, to assume the final retirement of all money invested or borrowed at a uniform annual rate from the time the bridge is opened to traffic. In this case the period for amortization of the cost of the property will be taken to be 48 years.

b. *Dividends to stockholders.*—In 1927 there was $8,264.69 net earnings available for dividends. This gives a return of about 0.35 per cent on the par value of the issued capital stock or 0.69 per cent on its book value. As has been stated, the future earnings are uncertain owing to the opening of another transbay bridge next spring.

c. *Plan of amortization.*—The annual allowance for amortization of both the cost of the property and the bond discount is approximately the total cost divided by the remaining life of the franchise or the period of maturity of the bonds. This is the "straight line method" of figuring depreciation. If placed in a sinking fund at 4½ per cent, the $43,146 charged off for depreciation would, if continued in force throughout, amortize the cost in about 27 years instead of a possible 48 years. Likewise the bond discount would be written off somewhat ahead of the average of maturity of the bonds.

The annual deposit in a sinking fund, with interest compounded at 4½ per cent, which will amortize the property cost ($2,124,820) in 48 years is about $13,200.

There follows a condensed operating statement for 1927 which has been referred to in the above discussion.

DUMBARTON BRIDGE COMPANY

Condensed operating statement, January 14, 1927, to December 31, 1927

Gross income, tolls		$159,854 71
Operating expenses:		
Salaries and wages	$16,094 41	
Supplies and miscellaneous expense	1,335 78	
Insurance and taxes	11,112 77	
Repairs and maintenance	193 98	
General and administrative:		
Advertising	10,478 50	
Salaries	2,344 70	
Legal expense	1,164 50	
Miscellaneous expense	2,272 84	
Total cost of operation		44,997 48
Net operating profit		$114,857 23
Interest on bonds	$56,062 50	
Interest on bank loans	880 47	
Amortization of bond discount	5,152 00	
Amortization of property	43,145 68	
	$105,240 65	
Less other income	997 33	
Total interest and amortization		104,243 32
		$10,613 91
Federal income tax on bond interest and earnings		2,349 22
Net earnings available for dividends		$8,264 69

The net earnings, if a sinking fund method of amortization is used to give equal annual payments over the 48 years remaining franchise life, would be about $38,000. This amounts to about 3.2 per cent on the book value of the stock.

10. Present value of the investment.

a. *Original cost.*—The actual book cost of Dumbarton Bridge Company's property to December 31, 1927, was:

Construction cost of bridge and approach roads		$1,683,258 57
Supervision		231,636 66
Interest on bonds		90,186 26
Amortization of bond discount and expense		11,017 11
Insurance and taxes		10,365 52
Organization and head office		39,504 08
Legal		2,529 52
		$2,068,497 72
Right of way		40,104 77
Bridge fixtures, tools and equipment		11,689 32
Office furniture and fixtures		851 25
Total property without depreciation		$2,121,143 06
(Depreciation value $2,078,198.27)		

b. *Capitalized value of net earnings.*—On the assumption that the average earnings for the period of the franchise may be represented by a yearly total of $160,000 to begin with which increases at an aver-

age rate of 3 per cent every year, the present worth of the earnings would be about $4,000,000.

The present worth of the average cost of operating estimated to be $116,000 per year, is $1,800,000.

The capitalized value of net earnings would, therefore, be the difference between these two figures or $2,200,000. In order to get back the $5 per share of capital stock at the end of the franchise, a sum of only $73,000 would have to be invested at 6 per cent interest.

e. *Estimated cost to the state.*—A study of actual bid prices on the construction work and quantities of major items indicates, as in the case of the other bridges, that the actual cost was not excessive but somewhat higher than would be expected on state work. Interest on bonds would be lower and there would be no organization expense. The cost to the state is estimated to be about $1,795,000.

EHRENBURG BRIDGE

2. General data and information.

a. *General description of the project.*—The toll bridge at Ehrenburg which crosses the Colorado River is an interstate bridge and is a connecting link between the Mecca-Blythe road (California state highway route 64) and the Ehrenburg-Phoenix road in Arizona. This route is the shortest one between Los Angeles and Phoenix but has the least traffic of any interstate route crossing the Colorado River. The conditions have been described in Section IV above.

The bridge is 950 feet long and consists of five 190-foot steel spans on concrete piers which rest on hard gravelly material. The width of the roadway is 20 feet. In the spring of 1928 one pier was washed out by a flood and a ferry has since been in operation pending the reconstruction of the pier and two steel spans which were wrecked by the failure of the pier.

Plate XIV, which follows, shows the general dimensions and the layout of the bridge.

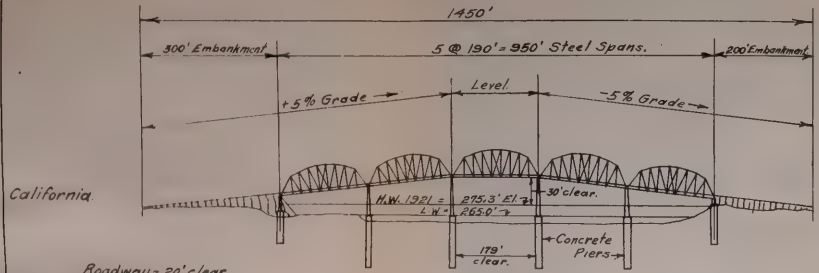
b. *Name and address of owning corporation and officials.*—The Ehrenburg Bridge is owned by the California-Arizona Bridge Company located at 721 Crocker Building, San Francisco. The officers of the company are as follows:

R. S. Shainwald, president; J. B. McCargar, vice president; Herman Phleger, treasurer; H. N. Baker, secretary. Directors: R. S. Shainwald, San Francisco; J. B. McCargar, San Francisco; Herman Phleger, San Francisco; J. L. Harrington, Kansas City; Floyd Brown, Blythe.

c. *Properties owned and operated.*—The California-Arizona Bridge Company operates no property other than the Ehrenburg Bridge. Most of the officers are also officers of the Dumbarton Bridge Company and the same head office serves for both corporations.

3. Organization of the project.

a. *General history and franchises obtained.*—In 1925 congress passed an act granting to John Lyle Harrington the consent of congress to construct a bridge across the Colorado River near the city of Blythe, in accordance with the provisions of an act entitled "An act to regulate the construction of bridges over navigable waters, approved March



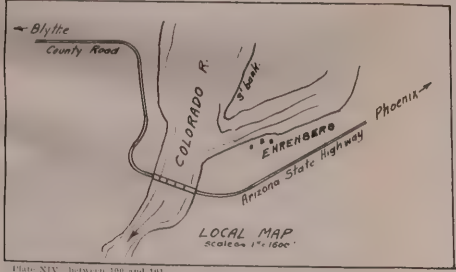


Plate XIV

INVESTIGATION OF TOLL BRIDGES

GENERAL PLAN OF BRIDGE

OVER

COLORADO RIVER NEAR EHRENBERG

SCALE HOR. 1" = 200'
VERT. 1" = 100'

23, 1906," provided that the location, design, plans and specifications be first submitted to and approved by the highway departments of the states of Arizona and California, as being safe and sufficient from the standpoint of the traffic which will pass thereover. This act was approved March 3, 1925.

Mr. Harrington submitted a sketch plan to the California Highway Commission. His original plan showed an 18-foot roadway but at the request of the state highway engineer he revised this to a 20-foot clear roadway. The highway department of the state of Arizona was requested to join in an inspection and study of the proposed site but replied that they could not participate. An inspection was made by engineers of the California Highway Department and on the recommendation of the state highway engineer, the California Highway Commission at its meeting October 23, 1925, passed a vote approving the revised plan subject to certain conditions relative to proper provisions being made for adequate foundations, that specifications and detail plans be submitted for approval, that work be subject at all times to inspection and that complete data regarding costs be made available.

The War Department approved the proposed bridge as far as navigation requirements were concerned but withheld final approval pending approval by the highway departments of the two states. The highway department of the state of Arizona did not, however, see fit to grant their approval to the project.

Therefore, in 1926, Mr. Harrington secured the passage of another act of congress, approved May 3, 1926, granting him permission to build the bridge subject to the approval of the Secretary of War, in accordance with the act of March 23, 1906, regulating the construction of bridges over navigable waters but not requiring the approval of highway departments of the two states as had been required in the previous act. A copy of this act is attached to this report. It authorizes John Lyle Harrington or his heirs or assigns to fix and charge tolls which shall be legal until changed by the Secretary of War; it provides that after completion of the bridge the state of Arizona, the state of California or any political subdivision adjoining the location may at any time take over the bridge by purchase or by condemnation; it provides that a sworn statement as to cost shall be filed with the Secretary of War within ninety days after completion; within three years the Secretary of War may investigate the actual cost and his findings shall be conclusive; it further provides that should bridge be taken over by the states or political subdivisions it may be operated as a toll bridge, tolls to be adjusted to pay cost of operation and maintenance, to pay an adequate return on the cost and to provide a sinking fund to amortize the amount paid within a period of not to exceed thirty years from the date of acquiring.

The bridge was built under this act of 1926. Plans were furnished to the California Highway Commission but no field inspection of the work during construction was made by this department as the state had no jurisdiction.

b. *Corporate history.*—The California-Arizona Bridge Company was incorporated under the laws of California, December 22, 1926, with an authorized capital stock of 35,000 shares at $10 par value each. This was later increased to 50,000 shares at $10 par value by permission of

the corporation commission of the State of California. The purpose for which the company was formed was to own and operate toll bridges and other bridges of every kind, in California or elsewhere.

Permits have been granted to the company to issue 26,910 shares of its capital stock for property and services in connection with the construction of the bridge and recently another 12,200 shares for river protection and other work. The latter permit was granted after the damage from floods in 1928 had occurred.

4. Financing the project.

a. *Sale of stock.*—The records of the corporation commission show permits for the following issues of stock:

10	shares at par, for cash, to the incorporators.
6,000	shares for services, to J. L. Harrington.
2,400	shares for land and ferry property, to Floyd Brown.
18,500	shares at $5 per share, for cash, to certain stockholders.
26,910	shares total issued previous to completion of the bridge.
12,200	shares at $5 per share, for cash, to present stockholders to pay for "river protection and other work."

All the stockholders are directors of the company, five in number. The balance sheet dated November 3, 1928, shows only 26,910 shares issued up to that time. Cost data furnished by the company July, 1928, shows only 1200 shares issued to Floyd Brown.

b. *Funded debt.*—The company has $125,000 first mortgage, 6½ per cent gold bonds, sold to the American Trust Company, which mature as follows:

$5,000	per year, 1932 to 1938 inclusive.
6,000	per year, 1939 to 1941 inclusive.
7,000	per year, 1942 to 1949 inclusive.
8,000	per year, 1950 to 1951 inclusive.

These bonds are callable at any time at 105 and accrued interest.

The total for bond discount and expenses, estimating the amount already amortized and charged to construction, is about $8,315. This leaves $116,685 as the net amount that was received from the sale of the bonds and makes the actual rate of interest paid for the money obtained about 7.3 per cent.

c. *Other sources of income for construction.*—The construction of the bridge was financed by the issue of bonds and the sale of stock. The stock apparently was sold only to the promoters and organizers of the project.

After the failure of the bridge in June, 1928, through the undermining of the pier, more money had to be spent in repairs and protection work. The balance sheet for November 3, 1928, shows, under accounts receivable, the amount of $89,579.66 from insurance claims. In addition to the bonds and capital stock, the balance sheet shows $127,167.11 in notes and accounts payable, against which there is $36,709.28 in cash and the insurance claim mentioned above.

5. Preliminary investigation and design.

a. *Investigation of site.*—The original plans, dated February 5, 1927, show that borings were made through various classifications of sand and gravel at points near piers 2, 4, 5 and 6. The deepest test hole, by scaling the plans, is found to extend about 65 feet below low water. It is understood that when the pier cylinders were sunk and excavated, a hard material was found, into which piles could only be driven with

difficulty, and steel rails were driven instead. As has been stated before, one pier (No. 2), was washed out during a flood and it is said that subsequent investigations of the foundation condition showed that 7 feet of compact material underlaid the pier and beneath this silt and debris was found. A jet under 250 pound pressure, using a 1¼ inch nozzle, stopped some 79 feet below ordinary water level but a 90 foot railroad rail was driven until its top was 8 feet below the water line and, since the plans show the bottom of the pier to be about 40 feet below the low water line, the rail must have penetrated 58 feet below that elevation.

b. *Engineers and comparative design studies.*—The bridge was designed by Harrington, Howard and Ash of Kansas City and the construction was supervised by Frank M. Cortelyou, who previously supervised the construction of the Dumbarton Bridge for the same firm.

The choice of a proper design, so far as span lengths and clearances are concerned, would be governed largely by the requirements and necessity for the approval of the War Department. The design and depth of the foundations depend upon a knowledge of the supporting material and the scouring action of the river. It is evident that the scouring action of the river was underestimated since a pier was washed out by a flood of 118,000 second feet, whereas a maximum flood of 160,000 second feet has been known to occur.

c. *Final design, plans and quantities.*—The final plans show a bridge consisting of five steel truss spans, 188 feet center to center of pins, having a concrete slab floor resting on steel joists. The trusses rest on concrete cylinder piers, the bases of which were to be constructed by driving interlocking steel sheet piling 45 feet long until the tops were 3 feet above low water to form a cylinder 10 feet 4½ inches in diameter, the material within the cylinders to be excavated to a depth of about 32 feet below water, but at least to hard gravel, and timber piles 78 feet long driven within the cylinders to a penetration about 38 feet below the bottom of the sheet piling. This would mean about 80 feet below low water. Instead of driving wood piles as stated, it is understood that steel rails were driven into the layer of hard material encountered at the bottom of the pier excavation.

The approximate quantities of materials in the structure are as follows:

Structural steel piling	270,000 lbs.
Reinforcing steel (piers)	16,500 lbs.
Concrete in steel cylinders	900 cu. yds.
Concrete in shafts, piers 1 to 5	400 cu. yds.
Concrete in shafts, pier 6	97 cu. yds.
Structural steel	1,206,000 lbs.
Reinforcing steel (slab)	44,000 lbs.
Concrete in slab and curbs	438 cu. yds.
Foundation piles (?)	6,200 lin. ft.
Embankment in place	3,500 cu. yds.

Miscellaneous items, riprap, tripods, guard rails and surfacing.

d. *Design loads and unit stresses.*—As is shown on the plans, the bridge was designed for a floor loading of two 12½ ton trucks or one 15 ton truck and a truss loading of 17,500 pounds concentrated load plus a uniform load of 375 pounds per lineal foot, all acting on a traffic lane 10 feet wide. The allowance for impact on the floor system was 30

per cent, except that 60 per cent was used for the end floor beams and all floor beam connections. For the trusses impact was added according to the formula.

$$\text{Impact} = \frac{L + 250}{10L + 500}$$

These design loadings correspond to loading "H12½" of the American Association of State Highway Officials' specifications and is below the standard of design used on state highway bridges, particularly on primary highways. The design of the piers is not in accordance with state bridge design practice with regard to their strength and stability and the damage from scour. The actual construction of the foundations, indicates that they can not be considered suitable until extensive and costly improvements are made which will insure their safety and stability.

The grade over the bridge has bumps at the changes in grade which make it poor riding and which are not at all in accordance with state practice.

Proposed tripods and willow mats around the piers will add to their safety and it is possible that the construction of the Boulder Dam will, by reducing the size of floods, remove most of the danger. Nevertheless, it appears that the structure has been so constructed, in the interests of economy, that the safety factors are too low.

6. Construction data.

a. *Contracts awarded.*—A contract for constructing the substructure, approaches, and erection of steel was awarded to Floyd Brown of Blythe, who for many years had superintended the work of flood control in the Colorado River. The bid price was $174,659. The contract for furnishing the steel was given to the Virginia Bridge and Iron Works. Floyd Brown was unable to complete the work at the price bid and the work was later assigned to the W. M. Ledbetter Company of Los Angeles, who completed the bridge in March, 1928.

The cost of construction to July 22, 1928, according to the secretary of the bridge company, was as follows:

Structural steel piling in place	$21,432 60
Reinforcing steel in place	1,657 28
Masses of bases within steel pile cylinders	26,492 40
Concrete in pier No. 1 to 5 inclusive	12,443 20
Concrete in pier No. 6	2,730 00
Foundation piles below bottom of concrete	67 70
River tripods	1,870 00
Embankment in place	3,493 58
Guard rails	841 69
Total unclassified work orders	7,744 69
Steel rails (not part of contract)	866 25
Superstructure metal fabricated and delivered	59,477 54
Superstructure metal erected	16,679 57
Reinforcing steel in floor and curbs	3,046 75
Concrete floor and curbs	8,570 75
Foundation piles	1,544 52
Shoes for foundation piles	165 85
	$169,123 08
Total credits	1,095 15
	$168,027 93

b. *Construction of bridge.*—All unusual details connected with the construction of the bridge have already been described so far as present information at hand will permit. There are no unusual construction problems connected with this structure, the only question in connection with the foundations being how much work should be done and money spent to make them absolutely secure.

c. *Miscellaneous work.*—As has also been mentioned, riprapping and other river protection works involving the use of tripods has been undertaken to avoid, if possible, a recurrence of the last disaster. A small amount of riprap was placed around the piers before the failure and it is now proposed to place willow mats around the piers as well as riprapping them.

7. Traffic and income.

a. *Present traffic and income.*—The bridge was opened to traffic on March 15, 1928, and failed during a flood on June 14, 1928. A traffic count taken by the highway department May 27th to 30th inclusive, gave an average of 41 cars per day. The bridge company gave as their total revenue for the 90-day period during which the bridge was in operation, the sum of $4,820.15, the average traffic being 41 cars per day. These figures give an average toll charge of $1.30, which amount seems reasonable according to the schedule of tolls, which is:

Autos and trucks up to 2 ton capacity	$1 00
Drivers, passengers and pedestrians, each	10
Trucks, 2 to 4 ton	1 50
Trucks, 4 to 6 ton	2 00
Trucks, over 6 tons	2 50

It appears that the interested parties made estimates based upon highway traffic counts from 1923 to 1926 taken at the quarantine stations near Blythe, Needles and Yuma and figured from it that traffic over the Ehrenburg Bridge would amount to 60,000 cars per year. With an estimated average toll of $1.15 the gross annual revenue would then be $69,000. An average of 41 cars per day would only amount to 15,000 vehicles per year which, at an average toll of $1.30, gives $19,500 as the annual gross revenue.

b. *Estimated future traffic.*—The future traffic over this bridge depends primarily on two factors; first, the improvement of the state and other *public* highways leading up to the bridge, and, second, the local development that may result from the construction of the Boulder Dam, also a public work. No estimate of any value whatever can be made as to the probable increase in traffic, without at least knowing at what rate these public works are to be carried on.

8. Operation and maintenance.

a. General and administrative costs amounted to $2,507 for the 90 days of operation, only $121 being paid out for advertising. From these figures and from those given for the Dumbarton Bridge, it is estimated that the average annual cost under this head would amount to about $10,000.

b. Collection of tolls.—The cost for items considered under this heading during the 90 days of operation amounted to $4,172.84. In the same way as before, it is estimated that the annual cost would be about $17,000.

c. Maintenance and repairs.—If the bridge is properly rebuilt and suitable protection works are installed, an annual maintenance fund of $4,500 should be enough to keep it in good condition.

d. Insurance and taxes.—For 90 days of operation the amount charged to insurance was $1,859.76 and to taxes $204.57. The total annual cost of both items is estimated to be $8,500.

9. Interest and amortization.

a. Interest on funded debt and working capital.—The annual interest on the present $125,000 of 6½ per cent bonds is $8,125. It is not known how the cost of repairs and betterments are to be financed. It is evident that the cost of repairing the damage done and of making the bridge secure against flood damage will cost a large amount and it seems certain that no one would underwrite any more bonds for this project when it was not able to pay the interest on the present funded debt. In addition to the interest, an annual amount of about $440 must be set aside to amortize the bond discount.

b. Dividends to stockholders.—As the project, without the added capital necessary for repairs and improvements, could not earn enough to pay interest on the funded debt, the question of dividends to stockholders seems to be a matter too far in the future for consideration at this time.

c. Plan of amortization.—As in the case of the other companies that have been described, amortization is charged off on practically the "straight line plan" which will pay off the cost of the project before the end of the franchise, unless the annual amounts written off are later reduced.

10. Present value of the investment.

a. Original cost.—From data received from the company on July 22, 1928, the cost up to that time was as follows:

Cost of construction	$168,027
Engineering	12,966
Interest and taxes during construction	9,691
Legal and overhead expense	3,653
Total money spent	$194,337
Stock at par value for franchises and organization work	60,000
Stock at par value for ferry property and land	12,000
	$266,337

The balance sheet of the company dated November 3, 1928, shows the following permanent assets:

Cost of construction	$254,463 31
Miscellaneous construction costs	10,264 43
Bridge fixtures	1,577 19
River control	2,150 60
Tools and equipment	51 99
Total	$268,507 52

Apparently only about $2,200 has been spent on repairing the structure and protection work up to November 3d. It appears that part of the fallen trusses and capsized pier sank to a considerable depth in the river bed, that the Naval Department has insisted upon their being removed and that the cost of carrying this out, together with the other necessary repair and improvement work, will be very high. It is reported that this cost may exceed $300,000.

b. Capitalized value of net earnings.—It has already been stated that it is not practical at this time to estimate the probable future traffic, that the final cost of the project is uncertain and that present gross earnings are not sufficient to pay interest on the outstanding bonds.

c. Estimated cost of construction by the state.—It is estimated that the bridge as originally constructed could have been duplicated by the state at a cost of about $200,000. However, as the evidence shows that the bridge as constructed is not in accordance with present state standards, that it is now actually out of commission on account of poor foundations and that it is likely that other piers may fail during future floods unless costly protection work is installed, any discussion of the cost of reproduction of the present structure is of no value.

Without a complete investigation of the river and foundation conditions the cost of a properly designed structure with suitable protection and river training works can not be estimated. It is quite probable that it might cost over half a million dollars and, therefore, it is seen from the data already given that the traffic, now or for several years to come, does not warrant the construction of such a bridge on this route from an investment point of view.

d. Cost of operation of a bridge constructed by the state.—As it has been stated that the cost of constructing a proper bridge structure on this route of travel cannot be estimated at this time, no definite figures for the cost of operation can be given.

The cost of operation and maintenance, exclusive of interest and depreciation or amortization, has been shown to be about $40,000 per annum under private ownership. Under state ownership no taxes would be paid and it is probable that the cost of administration charged to the project would be considerably less. Assuming that the annual cost under state operation would be $35,000, there would, unless tolls are raised, be an operating loss of about $15,500 before paying interest on the funded debt. If a suitable bridge were to cost, say $500,000, and money could be borrowed by the state at 4½ per cent interest, the bonds to be retired in 50 years time, the traffic would have to increase about 300 per cent before the present schedule of tolls would pay the annual cost of operation.

11. Summary and discussion of methods of acquiring and operating by the state.

The information regarding this toll bridge project may be summarized as follows:

The layout and design of the bridge does not conform to the present California state highway standards, particularly for bridges on primary highways.

The foundations of the structure are faulty, one pier having already been washed out and there is no evidence to show that the same may not happen to other piers unless costly changes are made.

The bridge was built at the best general location for a stream crossing within a distance of fifty miles along the river but it is not certain that the exact location is the best one within a distance of about 500 feet from the present location.

The river, which has kept to the same channel at this point from 1850 up to the time that a channel change was made persumably to protect the bridge, is now meandering in its channel and will require expensive training works to keep it where it belongs.

From the above facts it is apparent that no consideration should be given to methods of acquiring the bridge for state highway purposes, at least in its present condition. It is recommended that no money be expended by the State of California for the purchase of this structure.

The construction of a suitable bridge on this route by the states of California and Arizona is not pressing until a program of road construction between Mecca, California, and Phoenix, Arizona, is definitely underway. From an economic standpoint the improvement of the route would have to be carried to such a point that the traffic would be greatly increased over its present amount in order that the bridge could pay for itself through tolls. However, the half of the cost of this structure that the State of California would have to pay, would be no more than the cost of many structures already built out of the regular biennial construction budget.

SECTION VI

CONTEMPLATED TOLL BRIDGES

a. *Toll bridges for which franchises have either been applied for or for which franchises have been granted.*

Franchises have been granted for the following proposed privately owned toll bridges.

1. A project known as the Tomasini Bridge across San Francisco Bay from a point near Albany in Alameda County to a point near Tiburon in Marin County. The franchise was granted to T. A. Tomasini of San Francisco.

2. A project known as the Richmond-San Rafael Bridge across San Pablo Bay from a point near Richmond in Contra Costa County to a a point near San Rafael in Marin County. See section I, 2b and plate No. 1a.

Applications have been made by numerous companies and individuals for a franchise to construct and operate a toll bridge across San Francisco Bay between San Francisco and Oakland. See section I, 2b, this report.

All franchises applied for in San Francisco for this project have been rejected by the supervisors of San Francisco County. A recent application in Alameda County for this same project has been rejected by the supervisors of Alameda County. A question has arisen as to which county (San Francisco or Alameda) has jurisdiction to grant such a franchise.

A bridge across Golden Gate from San Francisco to a point in Marin County, west of Sausalito, is contemplated. The plan is to finance this project by a bond issue against a bridge district consisting of several counties benefited. It is understood that plans for such a bridge have been approved (in principal only) by the War Department.

b. *Discussion of various contemplated toll bridges.*

TOMASINI BRIDGE.

This proposed bridge extends over a portion of San Francisco Bay approximately 6½ miles wide. It is to consist of 14,700 lineal feet of structural steel and 11,500 lineal feet of reinforced concrete. The franchise states that the bridge shall be not less than 30 feet in roadway width and gives as an estimated cost $18,750,000. The toll provided in the franchise is 75 cents for a passenger automobile with 20 cents added for each person. The average truck toll provided in the franchise is approximately $1.50. The franchise is to run 50 years or to 1978.

Comparing this bridge with the other privately owned toll bridges, the estimated operating expense is as follows:

Administration	$75,000 00
Amortiation of 6½ per cent bonds over 50 years at 4½ per cent	105,000 00
Interest on bonds	1,218,750 00
Taxes and insurance	300,000 00
Collection of tolls	50,000 00
Amortization of bond discount	10,000 00
Advertising, etc.	25,000 00
	$1,783,750 00
Say	$1,800,000 00

If the average return per vehicle is $1.40 it will require a traffic of approximately 1,300,000 cars per year to pay operating expense. It is probable that such an amount of traffic will not develop for several years. All traffic now crossing the bay north of the Golden Gate at the present time is about 500,000 vehicles on the Richmond-San Rafael ferry and Sears Point Toll Road.

RICHMOND-SAN RAFAEL BRIDGE.

The traffic now passing over the Richmond-San Rafael Ferry amounts to approximately 330,000 cars per year, and the average toll per vehicle is approximately $1.20.

Statistics indicate that whenever a toll bridge replaces a toll ferry the traffic is normally increased from 30 per cent to 50 per cent during the first year of bridge operation. On this basis assuming an increase of 40 per cent in traffic, the traffic using a bridge replacing the Richmond-San Rafael Ferry would carry approximately 460,000 vehicles the first year. Assuming that the same tolls would be charged as are now being charged by the ferry, the gross income for the first year would be $550,000.

It has been estimated by the grantee of the franchise that the bridge would cost approximately $15,000,000.

Under private ownership the cost of operation per year is estimated as:

Administration	$75,000 00
Collection of toll	50,000 00
Bond interest at 7 per cent	1,005,000 00
Bond amortization at 4½ per cent over 47 years	88,500 00
Insurance and taxes	275,000 00
Bond discount amortization over 47 years at 4½ per cent	8,850 00
Maintenance and repairs	6,000 00
	$1,508,350 00

The present probable income at the rate of toll paid on the ferry is $550,000. If 40 per cent is added to the present traffic due to the added convenience of a bridge, the maximum present income that could be expected from a bridge would be $770,000 per year.

If an increase in traffic of 3 per cent is figured to 1950 and 2 per cent to 1978 (the end of the franchise) income would increase as follows:

1930	$770,000
1940	1,035,000
1950	1,390,000
1955	1,534,000
1960	1,694,000
1970	2,065,000
1980	2,517,000

Under these assumptions it is evident that a bridge with a capital investment of $15,000,000 will show a deficit until 1955.

If both the Tomasini and Richmond-San Rafael bridges were to be built, the traffic shown above would be divided between the two bridges and the income to each correspondingly reduced. It seems that an unprecedented development will have to take place in Marin, Contra Costa and northern Alameda counties to justify even one of these bridges, as an investment.

GOLDEN GATE BRIDGE.

It has been proposed to build a bridge across Golden Gate at the narrowest point, which is some distance west of the present San Francisco-Sausalito ferry. A district composed of San Francisco County and all the coast counties north of the bay has been formed to construct this bridge. It is proposed to build it as a publicly owned toll bridge, financed by a bond issue against these counties. If a law permitting the issuing of revenue bonds is passed this district might choose to use such a method of financing.

It is probable that a direct bond issue against the district could be financed at a lower interest rate than could a bond issue secured only by tolls.

It is assumed that a direct bond issue could be financed at 5 per cent and income bonds at 6 per cent. The estimated cost of this bridge is probably $30,000,000, although an estimate has been made by Mr. J. B. Strauss at about $18,000,000.

If the cost is $30,000,000 the annual cost of operation and amortization in seventy-five years is as follows:

Cost of collecting tolls	$75,000
Bond interest @ 6 per cent	1,800,000
Bond amortization @ 4 per cent	66,000
Insurance 2 per cent	600,000
Maintenance and repair	20,000
Administration	50,000
	$2,611,000

Present traffic over all ferries over the Golden Gate is 994,500. The present average toll on the ferries per vehicle is about $1.00. Assuming that traffic would be increased 30 per cent due to the added facilities of a bridge, the probable traffic in 1934 would be 1,464,000 vehicles and the probable income $1,464,000. Applying a 3 per cent increase in traffic yearly the project would show a deficit until 1955.

SAN FRANCISCO BAY BRIDGE—San Francisco to Alameda.

Extensive studies have been made of this project and its importance and necessity are recognized. Numerous types of bridges and tubes have been proposed. To date, however, the only factor which is established more definitely than some of the other proposed bridges is the probable traffic. There are now crossing the bay on ferries in the vicinity of this proposed bridge approximately 3,540,000 vehicles per year and 47,000,000 foot passengers. Reference is made to the extensive report on this subject by a board of eminent engineers to the supervisors of the city and county of San Francisco in May, 1927, also to numerous other reports on proposed bridges by private individuals and corporations with estimates varying from $25,000,000 to $116,000,000, depending on type and location.

It is impossible to make any accurate estimate of this project until extensive foundation surveys have been made.

It is evident that the least service which must be provided by a bridge or tube at this general location is a combination of interurban and automobile traffic. The cost of financing, constructing and operating a suitable structure must be kept at the lowest possible figure if the public is to receive the best service at the lowest cost. A conclusion is drawn that this can be accomplished only by public financing and construction.

APPENDIX

8—64951

BEFORE THE BOARD OF SUPERVISORS OF THE COUNTY OF CONTRA COSTA, STATE OF CALIFORNIA

In the matter of the application of Rodeo-Vallejo Ferry Company, a corporation, for authority to erect, construct and maintain a toll bridge and take tolls thereon across the Straits of Carquinez between Contra Costa County and Solano County, California.

ORDINANCE No. 171.

AN ORDINANCE GRANTING THE APPLICATION OF RODEO-VALLEJO FERRY COMPANY, A CORPORATION, AND FRANCHISE TO ERECT, CONSTRUCT AND MANTAIN A TOLL BRIDGE ACROSS THE STRAITS OF CARQUINEZ, BETWEEN THE COUNTY OF CONTRA COSTA AND COUNTY OF SOLANO, STATE OF CALIFORNIA, AND TAKE TOLLS THEREON.

The board of supervisors of the county of Contra Costa, State of California, do ordain as follows:

That the Rodeo-Vallejo Ferry Company, a corporation, organized and existing under and by virtue of the laws of the State of California, and having its principal place of business in the town of Rodeo, county of Contra Costa, State of California, having made its duly verified application in writing in due form of law to the board of supervisors of the county of Contra Costa for authority to erect, construct and maintain a toll bridge with the right, privilege, and permission to take tolls thereon across the Straits of Carquinez between the county of Contra Costa and the county of Solano, in the State of California, as described in the application of Rodeo-Vallejo Ferry Company, a corporation, therefor; and

Whereas, the county of Contra Costa, is the county on the left bank descending of the Straits of Carquinez, the body of water or stream across which it is proposed to erect, construct and maintain said bridge; and,

Whereas, this board has jurisdiction to hear and act upon said application, and,

Whereas, the board of supervisors of the county of Contra Costa, on the sixth day of November, 1922, proceeded to hear and did hear the application of said Rodeo-Vallejo Ferry Company, a corporation, and continued the further hearing thereon from time to time and until the eighth day of January, 1923, and said board of supervisors on said eighth day of January, 1923, all members thereof being present, duly passed and adopted a resolution expressing its desire to grant the privilege, permission and franchise to the Rodeo-Vallejo Ferry Company, a corporation, its successors and assigns, to erect, construct and maintain a toll bridge across the Straits of Carquinez, between the county of Contra Costa and the county of Solano, in the State of California, and having found and determined therein the precise point where such bridge is proposed to be located in the manner prescribed by law, and this honorable board having thereupon notified W. F. McClure, state engineer of the State of California, of such purpose and the precise point where such bridge is proposed to be located, and duly and regularly continued the further hearing of said application and the hearing thereon to this fifth day of February, 1923, and said engineer

having in accordance with law designated the length of the spans necessary to permit the free flow of water in said Straits of Carquinez, there being no draw in said bridge, and having filed in writing his designation as aforesaid, with the board of supervisors in pursuance of law on this fifth day of February, 1923.

And now on this fifth day of February, 1923, it fully appearing to the satisfaction of this board that due proof has been made that due and legal notice of said application of said Rodeo-Vallejo Ferry Company, a corporation, for the right and franchise to so erect, construct and maintain a toll bridge across said straits and to take tolls thereon and the time and place fixed for the hearing thereof and thereon has been made and given in all things in the manner and for the time prescribed by law, and this board having in open and regular session duly considered said application for such franchise and permission to take tolls thereon now determines and finds that the application of said Rodeo-Vallejo Ferry Company, a corporation, is in all things as required by law, and that due and legal notice of said application has been given in manner prescribed by law and that this board has jurisdiction to hear and act upon said application and grant said franchise.

That said toll bridge across said straits prayed for in said application of said Rodeo-Vallejo Ferry Company, a corporation, between the points and at the location determined by this board, is a public necessity.

That the expense of the erection, construction and maintenance of such a toll bridge as a free public highway is in the opinion of the board and this board so determines and finds too great to justify the erection, construction and maintenance thereof by the counties of Contra Costa and Solano.

That said bridge is a public necessity. That in the opinion of the board the public good and interests require the construction of said bridge. That the public good and public necessity will be promoted by the erection, construction and maintenance of said bridge as proposed by the said Rodeo-Vallejo Ferry Company, a corporation.

That said Rodeo-Vallejo Ferry Company is the owner of lands in Contra Costa County, California, hereinafter particularly described upon which the southern terminal of said bridge is to be located.

That the bridge as proposed to be erected by the Rodeo-Vallejo Ferry Company, a corporation, is of such type that it will not interfere with or obstruct navigation and will allow sufficient space or span to permit the safe, expeditious and convenient passage at all times of all vessels which may navigate said straits.

That there is no toll bridge at the proposed location nor is there any bridge whatever across said straits.

That there is no ferry operating across said Straits of Carquinez within a mile of the site of the proposed bridge, save and except that of said Rodeo-Vallejo Ferry Company, a corporation.

Thereupon, it is by the board of supervisors of the county of Contra Costa, State of California, ordered, that said bridge is a public necessity; that the public good and interests require the construction thereof; that the public good and interests and public necessity will be promoted by the erection, construction and maintenance of said bridge.

That said bridge is to be erected, constructed and maintained in a straight line across the Straits of Carquinez, between the county of

Contra Costa and the county of Solano, State of California, between the terminal points or location hereinafter described:

That the said application of the Rodeo-Vallejo Ferry Company, a corporation, is hereby granted, and the Rodeo-Vallejo Ferry Company, a corporation, its successors and assigns, is hereby granted the rights, privilege, permission, authority and franchise to erect, construct and maintain a toll bridge with the right to take tolls thereon across the Straits of Carquinez, between the county of Contra Costa and the county of Solano, State of California, in a straight line between the terminal points hereinafter particularly described, with the proper approaches thereto, for the term of twenty-five (25) years, from and after the effective date of the ordinance granting said franchise.

It is hereby ordered that at the expiration of term hereby granted the title to said toll bridge shall revert to the counties of Contra Costa and Solano.

Said bridge is to be constructed of concrete and steel and is to be of the suspension type or such other type as the War Department of the United States in its judgment may prescribe. It shall be of a height of one hundred thirty-five (135) feet in the clear above mean high water on said straits, at all points between the southerly proposed new pierhead line as hereafter described and the next pier north of said line. The breadth of said roadway of the said bridge shall be not less than thirty (30) feet; said bridge shall be constructed in all things in accordance with the requirements of the United States War Department. No pier of said bridge nor any portion thereof nor any other obstruction below said 135 feet clearance shall be placed in the Straits of Carquinez, between a straight line drawn from the northwest corner of the California and Hawaiian Sugar Refining Corporation's wharf and the northeast corner of Selby wharf (said line being the proposed new pierhead line to be established by the proper authorities of the United States) and a point one thousand (1000) feet northerly from said line.

That the location of the Contra Costa County terminal of said bridge is as follows:

Portion of Location No. 229, the State Tidelands, Contra Costa County, lying within the southeast quarter of section 31, township 3 north, range 3 west, M. D. B. and M., and more particularly described as follows, to wit:

Beginning at a point on the southerly side of the Straits of Carquinez 14.36 chains north of the southeast corner of section 31, township 3 north, range 3 west, Mount Diable meridian in the line of extreme low; thence south 5.07 chains to a station in the United States bulkhead line; thence north 89° 17′ west, running along said bulkhead line 5.57 chains to station; thence north 4.70 chains to station in low water line; thence north 87° east, 5.58 chains into the place of beginning, run by the true meridian, magnetic variation 17° 05′ east, containing 2.71 acres.

Also on that certain roadway situate in said county and state aforesaid and more particularly described as follows, to wit:

Commencing at a point where the center line of First avenue, town of Va'ona, Contra Costa County, intersects the southerly shore of Carquinez Straits in southerly line of Tideland Survey No. 44, C. C. Co., thence north 760 feet more or less, crossing the lands of the Northern Railway Co. and lands formerly owner by Mrs. Muir and the State

of California, to the line of the tract of 2.71 acres above described. The above described line is the center line of a 40-foot roadway.

That the location of the Solano County terminal of said bridge is as follows:

On that certain tract of land situate, lying and being in the county of Solano, State of California, and known as the James Clyne tract, located in the north half of section 32, and the south half of section 29, in township 3 north, range 3 west, M. D. B. and M., which said tract of land lies between the lands of the Pinole Dome Oil Company on the east and the lands of Antonio dos Reis and the lands of the Great Western Power Company in the west, and more particularly described as follows, to wit:

Beginning at the point of intersection of the line of mean high water on the north shore of Carquinez Straits with the westerly line of the James Clyne tract in section 32, township 3 north, range 3 west, M. D. B. and M. (if the public land surveys of the United States be considered extended over said land) and running thence northerly along said westerly line of the James Clyne tract, 600 feet to a point on said line; thence east 350 feet; thence south 550 feet more or less, to said line of mean high water on the north shore of Carquinez Straits; and thence westerly along said line of mean high water to the point of beginning.

The precise point on the above described locations where such bridge is to be located is as indicated on sheet 2 accompanying report of W. F. McClure, state engineer of the State of California, and dated February 1, 1923, and filed with the board of supervisors of Contra Costa County on the fifth day of February, 1923, reference to which is hereby made as a part hereof, and is particularly described as follows, to wit:

The bridge axis or center line is fixed by a straight line passing through the two following points:

1. Point P, which is the intersection of the bridge axis with the property line between James Clyne and the Great Western Power Company on the Solano shore. This point P is 410 feet from a point marked Q and measured along the boundary between the James Clyne property and that of the Great Western Power Company. This line bears south 32° west. The point Q is the intersection corner common to the properties of James Clyne, the Great Western Power Company and Manuel and Antonio dos Reis.

2. Point R, shown on sheet 2 on the Contra Costa side along the front property line of the Rodeo-Vallejo Ferry Company, which line bears north 87° east, the point R is 120 feet westerly along this line from the northeast corner of the Rodeo-Vallejo Ferry Company's property location 229, 2.71 acres; this northeast corner of the ferry company's property is 14.36 chains north of the intersection point common to sections 5, 6, 31 and 32.

That a penal bond be given by the Rodeo-Vallejo Ferry Company, a corporation, for the benefit of the county and all persons crossing or desiring to cross said bridge, in the sum of twenty-five thousand (25,000) dollars, conditioned as required by law, said bond to be given at least ten days before the operation of said bridge and the taking of tolls thereon.

That the Rodeo-Vallejo Ferry Company, a corporation, give bond in the county of Contra Costa, in the sum of fifty thousand (50,000) dollars, guaranteeing the faithful performance of all the terms and provisions of the ordinance granting franchise herein, said bond to be given within thirty days after the ordinance granting this franchise becomes effective, said bond not to be effective until after the approval of said bridge and franchise by the War Department of the United States.

That the license tax to be paid by the Rodeo-Vallejo Ferry Company, a corporation, its successors and assigns, for taking tolls on said bridge shall be one hundred (100) dollars per month, payable annually, commencing from date of the operation of said bridge. That two (2%) per cent of the gross receipts derived from the use and operation of said bridge shall also and in addition be paid to the county of Contra Costa, for the benefit of the counties of Contra Costa and Solano for the use of said franchise.

The actual construction of said bridge in good faith, shall be started within four months from the date of this ordinance granting said franchise and shall be completed within three years thereafter, or such further time as may be granted by the board of supervisors.

It is further ordered that the rate of tolls which may be collected for crossing said bridge shall be as fixed by the Railroad Commission of the State of California, and that in the event said Railroad Commission shall fail to fix such tolls then it is hereby further ordered that the rate of tolls which may be collected for crossing said bridge shall be as follows:

Automobiles.

	Rate
Ambulances, self propelled or horse drawn	$0 75
Automobiles	75
Automobile passenger busses	1 50

Bicycles.

Bicycle, accompanied by owner, each	25

Carts and Wagons.

Cart or wagon without horse	75
Push carts (attendant and freight extra) each	25

Commercial or Delivery Automobiles and Motor Trucks.

Not exceeding two tons capacity, each	1 00
Exceeding two tons capacity, each	1 50

Ditchers, Harvesters, etc.

Ditchers, harvesters, steam rollers, tractors, and all similar conveyances, machines, and vehicles charged on a basis of weight, per ton of 2000 lbs., at carrier's convenience, per ton	1 60

Cattle and Stock.

Cattle, per head, and stock in herds and uncrated, including one attendant, each	50
Sheep and swine uncrated and in herds, including one attendant, each	35

Commutation Rates.

Motor stages operated daily over a fixed route (minimum charge per day $10.00 per trip, includes driver but no passengers)	50
Daily round trip for automobiles and driver, per month	25 00

Freight.

Freight of all kinds on vehicles, per 1000 lbs. (minimum charge 20 cents)	40

Hearses.

Hearses, self propelled or horse drawn (with or without casket and corpse)	1 25

Horses.

Horse and wagon or cart, or pleasure vehicle	1 00
Two horses and wagon, or pleasure vehicle	1 50
Two horses and dray, or truck, or commercial vehicle	1 75
One horse or draft animal, not attached to vehicle, each	50
Each horse over two attached to vehicle, each	50

Motorcycles.

Motorcycles, each	25
Motorcycles, with side car, each	50

Trailers.

Two-wheel trailers attached to automobiles	50
Four-wheel trailers attached to automobiles or trucks (camping equipment in trailers charged as freight)	75

Passengers.

Passengers, drivers of vehicles and pedestrians, one way	15
Passengers, drivers of vehicles and pedestrians, round trip	25

Commutation Rates.

Passengers, drivers of vehicles and pedestrians, per month	3 00

Said bridge shall be constructed in accordance with the requirements of the United States War Department.

It is further ordered that this ordinance be published before the expiration of fifteen days after the passage thereof, together with the names of the members of the board voting for and against the same, for at least one week in the Contra Costa Gazette, a newspaper printed and published in the county of Contra Costa.

This ordinance shall become effective thirty days from and after its passage.

The foregoing ordinance was adopted this fifth day of February, 1923, by the following vote:

Ayes: Supervisors Zeb Knott, C. H. Hayden, W. J. Buchanan and R. J. Trembath.

Noes: Supervisors—None.

Absent: Supervisor J. P. Casey.

{ Seal of Board of } W. J. BUCHANAN,
{ Supervisors. } Chairman of the Board of Supervisors
of the County of Contra Costa.

Attest: J. H. WELLS,
Clerk of Board of Supervisors.

BEFORE THE BOARD OF SUPERVISORS OF THE COUNTY OF CONTRA COSTA, STATE OF CALIFORNIA

In the matter of the application of Delta Bridge Corporation, a corporation, for authority to erect, construct, and maintain a toll bridge and take tolls thereon across the San Joaquin River, between Contra Costa County and Sacramento County, California.

ORDINANCE No. 175

AN ORDINANCE GRANTING THE APPLICATION OF DELTA BRIDGE CORPORATION, A CORPORATION, A FRANCHISE TO ERECT, CONSTRUCT AND MAINTAIN A TOLL BRIDGE ACROSS THE SAN JOAQUIN RIVER BETWEEN THE COUNTY OF CONTRA COSTA, AND THE COUNTY OF SACRAMENTO, STATE OF CALIFORNIA, AND TAKE TOLLS THEREON.

The board of supervisors of the county of Contra Costa, State of California, do ordain as follows:

That the Delta Bridge Corporation, a corporation organized and existing under and by virtue of the laws of the State of California, and having its principal place of business in the city and county of San Francisco, State of California, having made its duly verified application in writing in due form of law to the board of supervisors of county of Contra Costa, for authority to erect, construct, and maintain a toll bridge with the right, privilege and permission to take tolls thereon across the San Joaquin River between the county of Contra Costa and the county of Sacramento, in the State of California, as described in the application of said Delta Bridge Corporation, a corporation, therefor; and

Whereas, the county of Contra Costa is the county on the left bank descending of the San Joaquin River, the body of water or stream across which it is proposed to erect, construct and maintain said bridge, and

Whereas, this board has jurisdiction to hear and act upon said application, and

Whereas, this board of supervisors of the county of Contra Costa on the fifth day of March, 1923, proceeded to hear and did hear the application of said Delta Bridge Corporation, a corporation, and said board of supervisors on said fifth day of March, 1923, all members thereof being present, duly passed and adopted a resolution expressing its desire to grant the privilege, permission and franchise to the said Delta Bridge Corporation, a corporation, its successors and assigns, to erect, construct and maintain a toll bridge across the San Joaquin River between the county of Contra Costa and the county of Sacramento, in the State of California, and having found and determined therein the precise point where such bridge is proposed to be located in the manner prescribed by law, and this honoraple board having thereupon notified W. F. McClure, state engineer of the State of California, of such purpose and the precise point where such bridge is proposed to be located for his action as required by law, and said engineer having in accordance with law designated width of the draw to be made in such bridge and also the length of the spans necessary to permit the free flow of water in said San Joaquin River, and having

filed in writing his designation as aforesaid, with the board of supervisors in pursuance of law on this twenty-third day of May, 1923;

And now on this fourth day of June, 1923, it fully appearing to the satisfaction of this board that due proof has been made that due and legal notice of said application of said Delta Bridge Corporation, a corporation, for the right and franchise to so erect, construct and maintain a toll bridge across said river and to take tolls thereon and the time and place fixed for the hearing thereof and thereon has been made and given in all things in the manner and for the time prescribed by law, and this board having in open and regular session duly considered said application for such franchise and permission to take tolls thereon, now determines and finds that the application of said Delta Bridge Corporation, a corporation, is in all things required by law, and that due and legal notice of said application has been given in the manner prescribed by law and that this board has jurisdiction to hear and act upon said application and grant said franchise.

That said toll bridge across said San Joaquin River as prayed for in said application of said Delta Bridge Corporation, a corporation, between the points and at the location heretofore determined by this board, is a public necessity.

That the expense of the erection, construction and maintenance of such a toll bridge as a free public highway is, in the opinion of the board, and this board so determines and finds, too great to justify the erection, construction and maintenance thereof by the counties of Contra Costa and Sacramento.

That said bridge is a public necessity. That in the opinion of the board, the public good and interests require the construction of said bridge. That the public good and public necessity will be promoted by the erection, construction and maintenance of said bridge as proposed by the said Delta Bridge Corporation, a corporation.

That said Delta Bridge Corporation, is the owner of lands in Contra Costa County, California, hereinafter particularly described, upon which the southern terminal of said bridge is to be located.

That the bridge as proposed to be erected by the Delta Bridge Corporation, a corporation, is of such type that it will not interfere with or obstruct navigation and will allow sufficient space of span and draw to permit the safe, expeditious and convenient passage at all times of all vessels which may navigate said straits.

That there is no toll bridge at or near the proposed location.

That there is a ferry operated across said San Joaquin River within a mile of the site of the proposed bridge by C. A. Lauritzen and H.F. Lauritzen, doing business under the firm name and style of Antioch and Sherman Island Ferry Company, who consent in writing to the granting by the board of supervisors of a toll bridge franchise to the said Delta Bridge Corporation and the erection and maintenance of a toll bridge as prayed for in the application of said corporation.

Thereupon, it is by the board of supervisors of the county of Contra Costa, State of California, ordered, that said bridge is a public necessity; that the public good and interests require the construction thereof; that the public good and interests and public necessity will be promoted by the erection, construction and maintenance of said bridge.

That said bridge is to be erected, constructed and maintained in a straight line across the San Joaquin River between the county of Contra Costa and the county of Sacramento, State of California, between the terminal points and locations hereinafter described.

That the application of the Delta Bridge Corporation, a corporation, is hereby granted, and the Delta Bridge Corporation, a corporation, its successors and assigns, is hereby granted the right, privilege, permission, authority and franchise to erect, construct and maintain a toll bridge with the right to take tolls thereon across the San Joaquin River between the county of Contra Costa and the county of Sacramento, State of California, in a straight line between the terminal points hereinafter particularly described, with the proper approaches thereto, for the term of twenty-five (25) years, from and after the effective date of the ordinance granting said franchise.

It is hereby ordered that at the expiration of term hereby granted, the title to said toll bridge shall revert to the counties of Contra Costa and Sacramento.

Said bridge to be constructed of concrete and steel and wood, and is to be of the low-level type or such other type as the War Department of the United States in its judgment may prescribe. It shall be of a height of not less than twelve (12) feet in the clear above mean high water on the said San Joaquin River. The breadth of the roadway of the said bridge shall be not less than twenty-one (21) feet; said bridge shall be constructed in all things in accordance with the requirements of the United States War Department.

The center line of said bridge shall be thirty (30) feet easterly from and parallel with the section line between sections 15 and 16, T. 2 N., R. 2 E., M. D. B and M. and the prolongation northerly across said San Joaquin River.

The northerly or Sacramento County terminal of said bridge is as follows, to wit:

Beginning at a point on Sherman Island, in Sacramento County, California, on the line between sections 9 and 10, T. 2 N., R. 2 E., M. D. B. and M. and 50 feet north of the north shore of the San Joaquin River, and from which point the section corner common to sections 15 and 16, 21 and 22 of said township bears south 6420 feet more or less and running thence east 60 feet to a point; thence running south 50 feet more or less to a point at mean low water on the north bank of San Joaquin River; thence running westerly 60 feet more or less, along mean low water line to a point on said section line; thence running north along said section line 50 feet to the place of beginning;

The southerly or Contra Costa County terminal of said bridge is as follows, to wit:

Beginning at a point in the center of the county road on the section line between sections 15 and 16, T. 2 N., R. 2 E., M. D. B. and M. Contra Costa County, California, from which point the section corner at the common corner of sections 15, 16, 21 and 22 of said township bears south 2645 feet thence running north 50 feet more or less to a

point at mean low water on the south bank of San Joaquin River; thence running easterly along the line of mean low water 60 feet more or less, to a point which is 60 feet due east of said section line; thence running south 50 feet more or less to a point from which the place of beginning bears west 60 feet; thence running west 60 feet to the place of beginning.

The above described center line and the above described terminal points shall constitute the precise point where such bridge is proposed to be located. Provided, however, that the said applicant or its assigns may construct at the northerly or Sherman Island end of the bridge and on the east side thereof, a flared or widened section to connect suitably with the road on Sherman Island, said section to be bounded on the easterly side thereof by a curve of not to exceed two hundred (200) feet radius.

The width of the draw to be made in said bridge to be two hundred (200) feet long at right angles to axis of channel and the length of spans on both sides of the draw shall be sixty-five (65) feet and forty (40) feet from center to center respectively as indicated by state engineer W. F. McClure, on blue print of same approved May 21, 1923, now on file in office of the clerk of the board of supervisors of Contra Costa County, California, to which reference is hereby made for particulars.

That a penal bond be given by the Delta Bridge Corporation, a corporation, for the benefit of the county and all persons crossing or desiring to cross said bridge, in the sum of twenty-five thousand (25,000 dollars, conditioned as required by law, said bond to be given at least ten days before the operation of said bridge and the taking of tolls thereon.

That the license tax to be paid by the Delta Bridge Corporation, a corporation, its successors and assigns, for taking tolls on said bridge shall be one hundred ($100) dollars per month, payable annually commencing from date of the operation of said bridge. That two (2%) per cent of the gross receipts derived from the use and operation of said bridge shall also and in addition be paid to the county of Contra Costa for the benefit of the counties of Contra Costa and Sacramento for the use of said franchise.

The actual construction of the said bridge in good faith, shall be started within four months after the date of the issuance of permit herein by the United States War Department and shall be completed within three years thereafter or such further time as may be granted by the board of supervisors.

It is further ordered that the rate of tolls which may be collected for crossing said bridge shall be as fixed by the Railroad Commission of the State of California, and that in the event said Railroad Commission shall fail to fix such tolls then it is hereby further ordered that the rate of tolls which may be collected for crossing said bridge is as follows:

	Rate
Automobiles.	
Ambulances, self-propelled or horse-drawn	$0 75
Automobiles	75
Automobile passenger busses	1 50
Bicycles.	
Bicycle accompanied by owner, each	25
Carts and Wagons.	
Cart or wagon without horse	75
Push carts (attendant and freight extra) each	25
Commercial and delivery automobiles and motor trucks.	
Not exceeding two tons capacity each	1 00
Exceeding two tons capacity—each	1 50
Ditchers, harvesters, etc.	
Ditchers, harvesters, steam rollers, tractors and all similar conveyances, machines and vehicles charged on a basis of weight, per ton, of 2000 pounds at carrier's convenience, ton	1 60
Cattle and stock.	
Cattle, per head, and stock in herds and uncrated, including one attendant, each	50
Sheep and swine uncrated and in herds, including one attendant, each	35
Commutation rates.	
Motor stages operated daily over a fixed route (minimum charge per day $10 per trip, includes driver but no passengers)	50
Daily round trip for automobiles, and driver, per month	25 00
Freight.	
Freight of all kinds on vehicles, per 1000 lbs. (minimum charge 20 cents)	40
Hearses.	
Hearses, self-propelled or horse drawn (with or without casket and corpse)	1 25
Horses.	
Horse and wagon or cart, or pleasure vehicle	1 00
Two horses and wagon, or pleasure vehicle	1 50
Two horses and dray, or truck or commercial vehicle	1 75
One horse or draft animal, not attached to vehicle each	50
Each horse over two attached to vehicle each	50
Motorcycles.	
Motorcycles, each	25
Motorcycles, with side car, each	50
Trailers.	
Two-wheel trailers attached to automobiles	50
Four-wheel trailers attached to automobiles or trucks (camping equipment in trailers charged as freight)	75
Passengers.	
Passengers, drivers of vehicles and pedestrians, one way	15
Passengers, drivers of vehicles and pedestrians, round trip	25
Commutation Rates.	
Passengers, drivers of vehicles and pedestrians, per month	3 00

Said bridge shall be constructed in accordance with the requirements of the United States War Department.

It is further ordered that this ordinance be published before the expiration of fifteen days after the passage thereof together with the names of the members of the board voting for and against the same for at least one week in the Contra Costa Gazette, a newspaper printed and published in the county of Contra Costa.

This ordinance shall become effective thirty days from and after its passage.

The foregoing ordinance was adopted this fourth day of June, 1923, by the following vote:

Ayes: Supervisors Zeb Knott, J. P. Casey, C. H. Hayden, and W. J. Buchanan and R. J. Trembath.

Noes: None.

Absent: Supervisors—none.

W. J. BUCHANAN (Signed)
Chairman of the board of supervisors of the County of Contra Costa.

Attest:

J. H. WELLS, Clerk of the board of supervisors.

ORDINANCE No. 352.

An ordinance granting the application of Frank C. Towns, Mark E. Noon, and A. W. Deuel, as joint tenants, their survivor or survivors or assigns, for authority to construct, maintain and operate a toll bridge across San Francisco Bay between the county of San Mateo and the county of Alameda, State of California, granting a franchise for said purpose, prescribing the terms and conditions thereof; fixing the rate of tolls; providing for the payment of a license tax; and fixing the term of said franchise.

The application of Frank C. Towns, Mark E. Noon and A. W. Deuel for authority, license and franchise to construct, maintain and operate a toll bridge across San Francisco Bay and to take tolls thereon, coming on regularly to be heard before the board of supervisors of the county of San Mateo, State of California, this eleventh day of July, 1927, in open session of the said board, and it appearing to the said board, and said board so finds, that notice of said application was duly published in the manner and form and for the time as required by law in the "San Mateo Times and Daily News Leader" and the "Burlingame Advance," each of which is a newspaper of general circulation published and circulated in the county of San Mateo, State of California, and in the "Oakland Tribune," a newspaper of general circulation, published and circulated in the county of Alameda, State of California, and that on the sixth day of June, 1927, pursuant to a resolution duly made, seconded and passed by this board a communication was sent to the state engineer of the State of California notifying said state engineer of the purpose of this board to grant to said Frank C. Towns, Mark E. Noon and A. W. Deuel a franchise to construct, maintain and operate a toll bridge across San Francisco Bay and specifying the precise point where such bridge is to be located, and that within the time and in the manner provided by law and within ten (10) days after the receipt by said engineer of said notice, the said state engineer by written communication to said board designated the width of draw to be made in said bridge and also the length of spans necessary to permit the free flow of water, and that said communication from said state engineer fixing the draw and span was on the thirteenth day of June, 1927, spread upon the minutes of this board as required by law, and this board further finds that the construction, maintenance and operation of said bridge is a public necessity and convenience.

Now, therefore, the board of supervisors of the county of San Mateo, State of California, in meeting assembled do hereby find that said application of said Frank C. Towns, Mark E. Noon, and A. W. Deuel is regularly before this board of supervisors of San Mateo County at this time and that all proceedings and acts and things required by law be done and taken have been duly and regularly had and taken by said Frank C. Towns, Mark E. Noon and A. W. Deuel and by this board preliminary to granting and obtaining said authority, license and franchise.

Now, therefore, the board of supervisors of the county of San Mateo, State of California, do ordain as follows:

Section 1. The right, authority, license and franchise is hereby granted to Frank C. Towns Mark E. Noon and A. W. Deuel,

as joint tenants, their survivor or survivors and assigns, to construct, maintain and operate for the term of fifty (50) years from and after the passage of this ordinance, a toll bridge, together with the approaches thereto, across and upon and over which may pass or be transported persons, freight and vehicles of all kinds and howsoever drawn or propelled, including automobiles, trucks, wagons and property of every nature carried or transported thereon or thereby, and for any and all other lawful purposes. Said bridge shall be located, built and constructed across San Francisco Bay from

A point on the knoll on Little Coyote Point, county of San Mateo, State of California, designated on government maps as Guano Island, (Longitude West 122° 15′ 43.479″, Latitude North 37° 34′ 23.649″); thence North 41° 8′ East 8320.6 feet crossing the main ship channel; thence along the arc of a 6° curve to the right 472.5 feet; thence North 69° 29′ East 28,771.5 feet, more or less, to a point in the county of Alameda, State of California, on the eastern shore line of said San Francisco Bay at or near the point where the county road running southwesterly from the town of Mount Eden, county of Alameda, State of California, would, if extended in a straight line, meet the said eastern shore line of said bay.

Said toll bridge to have an approximate length of thirty-seven thousand five hundred sixty-five (37,565) feet more or less from shore line to shore line, and a breadth of thirty (30) feet more or less, with width of draw and lengths of spans as provided in said communication heretofore received from the state engineer of the State of California.

Section 2. The right and authority is hereby granted to said Frank C. Towns, Mark E. Noon and A. W. Deuel as joint tenants, their survivor or survivors and assigns, to make all necessary approaches, and all needful and convenient excavations and fills, in and adjacent to said bridge and approaches thereto, and also to install, operate and maintain at suitable and convenient points along said bridge and the approaches thereto, steam, gasoline, electric power equipment and engines, and boiler and electric plants of ample and sufficient power to operate the said bridge, and any draws, lifts and cantilevers thereon, or connected therewith, and convenient or necessary in order to carry on the activities specified in this ordinance, and other appurtenances and appliances and accessories necessary or convenient to the use or operation of said bridge, or convenient for the use of the traveling public, including telephone, telegraph, water, gas and pipe lines and electric lines of all kinds.

Section 3. It has been shown before the said board, and the said board so finds, that the actual cost of the construction of said bridge and the fair and actual cash value thereof when completed, will be approximately seven million five hundred thousand ($7,500,000) dollars, and that the annual cost of all necessary repairs, operation, maintenance, amortization and taxes of said bridge will be three hundred forty thousand ($340,000) dollars, or thereabouts, and in view thereof this board does hereby fix the rate of tolls which the said Frank C. Towns, Mark E. Noon and A. W. Deuel as joint tenants, their survivor or survivors and assigns, shall, and are hereby authorized to collect, for the use of, or for the passage over said bridge or any part thereof, or any approach thereto, each way, to be and the same are hereby fixed as follows, to wit:

For each truck of 10 tons capacity, $1.50.
For each truck of 6 tons capacity, $1.25.
For each truck of 5 tons capacity, $1.00.
For each truck of 4 tons capacity, 90 cents.
For each truck of 3 tons capacity, 80 cents.
For each truck of 2 tons capacity, 70 cents.
For each truck of 1 ton capacity, 60 cents.
For each trailer, 50 cents.
For each wagon of 10 tons capacity, $1.00.
For each wagon of 6 tons capacity, 90 cents.
For each wagon of 5 tons capacity, 80 cents.
For each stage, $1.00.
For each 7-passenger automobile, 50 cents.
For each 5-passenger automobile, 45 cents.
For each 2-passenger automobile, 40 cents.
For each tri-car, 30 cents.
For each motorcycle, 20 cents.
For vehicles other than those herein specified, $1.00.
For each person, 5 cents.
For freight and other property, however transported, 50 cents per ton.

Public peace officers, public firemen, and letter-carriers with their vehicles and apparatus, when upon public business, shall be permitted to pass over said bridge free of tolls.

No separate toll or charge, other than those specified herein, shall be made for transportation or passage over any approach to said bridge.

Should the owner or owners of this franchise find is necessary or convenient at any time or from time to time, to establish a toll rate, or toll charge, to cover the passage over said bridge of property, or vehicles, which do not fall within any of the above listed toll rates, or toll charges, said board of supervisors shall, upon proper representation and showing by the owners of this franchise, establish such additional toll rates, or toll charges, as shall be in conformity with a fair return to the owners of this franchise upon their investment.

Section 4. Said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns, shall pay the county of San Mateo the sum of one hundred dollars ($100) per month, payable annually commencing from the date of the operation of said bridge and continuing until the expiration of this franchise as a license tax for taking tolls upon said bridge.

Section 5. Said Frank C. Towns, Mark E. Noon and A. W. Deuel have caused their engineers to make a survey of the site of said bridge, and have made all soundings, borings, tests, plans and estimates necessary for the placing of contracts for the construction of said bridge, and for the filing of an application for the permit of the War Department of the United States of America to construct the same; now, therefore, it is directed and provided that within a reasonable time after the said War Department permit has been issued, the said Frank C. Towns, Mark E. Noon, and A. W. Deuel, their survivor or survivors and assigns, shall execute contracts for the actual construction of the bridge, and work thereon shall be commenced within sixty (60) days after the signing of said contracts and shall be prosecuted diligently thereafter (except when prevented by act of God, the public enemy, riots, strikes,

legal proceedings, the elements or any other cause whatsoever beyond the control of the contractor), until a bridge of at least thirty (30) feet, more or less, in width shall have been completed, which said bridge shall be completed within three (3) years from the passage of this ordinance.

Section 6. The said Frank C. Towns, Mark E. Noon, and A. W. Deuel, their survivor or survivors and assigns, shall on or before the commencement of the construction of said bridge and any enlargements or additions thereto, file in the office of the clerk of the board of supervisors of the county of San Mateo, State of California, a copy of the plans and specifications for said work, together with a copy of all permits granted to them, or either of them, to construct and operate said bridge by the United States of America or any officer of the State of California.

Section 7. Said Frank C. Towns, Mark E. Noon and A. W. Deuel, as joint tenants, their survivor or survivors, or assigns, shall before commencing the construction of said bridge, file a bond in the sum of $100,000 with one or more sureties, in accordance with sections 2845 and 2850 of the Political Code of the State of California, and said bond shall be renewed annually.

Section 8. At or before the time of the completion of said bridge said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns, shall procure, or cause to be procured a right of way for a highway or road from each end of said bridge, to wit: one in the county of San Mateo and the other in the county of Alameda, which right of way shall extend from each end of said bridge to connect with a public highway upon which said rights of way a proper pavement of a width equal to the roadway of said bridge shall be constructed.

Section 9. It is further provided that if the said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns, should be unable to perform any act or condition herein set forth in the time and as herein provided, that the said board of supervisors of the county of San Mateo may upon a proper showing of due diligence and good faith on the part of said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns, extend said period of time for performing each act or condition. In the event that there shall be a delay in the granting of permits by the War Department of the United States of America, or in the event that it shall be necessary for the said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns, to institute or maintain any legal proceedings in order that they shall be entitled to the benefits and privileges herein granted to them, or in the event that any legal proceedings shall be instituted to prevent said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns from doing any of the things herein required or permitted to be done by said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns, then the time specified herein within which such acts and promises are to be performed shall be extended at least thirty (30) days after the necessary permits of said War Department shall have been granted, and thirty (30) days after such legal proceedings shall have been finally determined and ended; *provided, however*, that any such legal proceedings instituted by said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns as aforesaid, shall be diligently prosecuted and

Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns as aforesaid, shall be diligently and promptly defended without any unreasonable delay.

Section 10. It is further provided that the county of San Mateo shall be allowed to erect and construct and maintain, at its own cost and expense, police and fire alarm wires and boxes over, upon and along said bridge, and if a conduit system is installed thereon to construct a conduit for said wires.

Section 11. The refusal, neglect or omission of said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns, to do, perform or abide by any or all of the terms, conditions and covenants in this ordinance contained shall (subject to the provisions of section 9 hereof) give to this board of supervisors the immediate right to forfeit the franchise hereby granted; *provided, however*, that this board of supervisors shall first give the said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns a reasonable opportunity to be heard thereon and to perform.

Section 12. In order that this franchise shall be effective and in operation, the said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns, shall within thirty (30) days after this ordinance shall become effective, file in the office of the clerk of the board of supervisors of the county of San Mateo, State of California, their acceptance in writing of the provisions of this ordinance and thereupon all the provisions of this ordinance shall be taken and deemed as a contract between said county of San Mateo and said Frank C. Towns, Mark E. Noon and A. W. Deuel, their survivor or survivors and assigns. If such acceptance is not filed, this ordinance is null and void.

Section 13. Each and every assignment of said franchise must be in writing and exact copies thereof must be filed with the clerk of this board.

Section 14. If any section, sentence or portion thereof herein contained shall for any reason be void or illegal, such fact shall not affect the validity of the remaining portions of this ordinance; and said board of supervisors hereby declares that it would have passed this act and each and every other section, sentence or portion thereof irrespective of the fact that any one or more sections, sentences or portions thereof be held void or illegal.

Section 15. This ordinance shall take effect and be in force from and after thirty (30) days after its passage.

Passed and adopted by the board of supervisors of said county of San Mateo, as an ordinance of said county at a session and regular meeting of said board of supervisors held this eleventh day of July, A. D. 1927, by the following vote:

Ayes, in favor of the passage of said ordinance: Supervisors T. L. Hickey, Rosalie M. Brown, Manuel Francis, C. V. Thompson, J. W. Poole.

Noes, and against the passage of said ordinance: Supervisors: None.

Absent: Supervisors: None.

Approved and attested this eleventh day of July, 1927.

J. W. POOLE,
Chairman of the board of supervisors of the
[SEAL] County of San Mateo, State of California.

ELIZABETH M. KNEESE,
Clerk of said board of supervisors.

NO. 330

AN ORDINANCE

GRANTING UNTO JOHN LYLE HARRINGTON, HIS HEIRS AND ASSIGNS, AUTHORITY TO CONSTRUCT, OPERATE AND MAINTAIN A TOLL BRIDGE ACROSS SAN FRANCISCO BAY, AS HEREIN PROVIDED.

John Lyle Harrington, applicant under the laws of the State of California, for authority for himself, his heirs and assigns, to construct, operate and maintain a toll bridge across San Francisco Bay from a point in the county of Alameda, in the State of California, to a point in the county of San Mateo, in said state, having published and given notice, in accordance with the law of said state in such case made and provided, specifying the location and the length and breadth of the toll bridge, and having specified in said notice a regular meeting of this board at the hour of ten o'clock in the forenoon on Monday, the seventeenth day of November, 1924, as the time and meeting at which the application required by the laws of the State of California would be made to this board, and the said applicant having at said time and meeting, the same being a regular meeting of this board, made application, as required by law, to the board of supervisors of the county of San Mateo, for authority to construct, operate and maintain the said toll bridge specified in said notice, and the said board having, pursuant to the authority granted by section 2871 of the Political Code of the State of California, regularly adjourned the hearing of said application until the nineteenth day of November, 1924, at the hour of ten o'clock in the forenoon, and thereafter and on said last mentioned date of said hearing having been regularly adjourned until the twentieth day of November, 1924, at the hour of ten o'clock in the forenoon, and the hearing of said application having been had and held by this board at said last mentioned time and the said board of supervisors of the county of San Mateo being now fully advised and informed in the premises, and satisfied therewith, and being of the opinion that the public interests will be promoted by constructing, operating and maintaining the said toll bridge and the granting of said application therefore.....

The board of supervisors of the county of San Mateo do ordain as follows:

Section 1. There is hereby granted the application of John Lyle Harrington regularly made to this board at a regular meeting on the seventeenth day of November, 1924, for a grant to himself, his heirs and assigns (hereinafter referred to as and called the franchise grantee), of the authority, right, privilege and franchise to construct, and to operate and maintain for the term of fifty, (50), years, a toll bridge across San Francisco Bay from a point in the county of Alameda in said state, across said bay and approximately parallel to the Southern Pacific Railroad bridge, as the same now exists across Dumbarton Straights, and distant about three-quarters of a mile northwesterly from said railroad bridge, to a point on the westerly shore

of said San Francisco Bay, in the county of San Mateo, in said state, the said toll bridge, the authority, right, privilege and franchise to construct, operate and maintain which, for the term of fifty (50) years, are hereby granted, including the approaches essential and necessary to connect the portions of said bridge over shallow and deep water with public highways in said counties and render such portions thereof accessible, passable and usable from such public highways, being particularly described as follows, to wit: _____ an easterly approach extending from a point on a public highway near Jarvis Landing, in the county of Alameda, State of California, to a point on the main channel of San Francisco Bay near the mouth of Beard Creek in said county, thence southwesterly and approximately parallel to the Southern Pacific Railroad bridge, as the same now exists across Dumbarton Straits, and distant about three-quarters of a mile northwesterly from said railroad birdge to the westerly shore of the main channel of said San Francisco Bay, thence westerly to a firm land point on a public highway on the westerly shore of said San Francisco Bay, in the county of San Mateo; the portion of said bridge over the deepest water of said bay, about two thousand (2000) feet in length, to consist of a group of through-truss steel spans supported by concrete piers founded on piles, one span to be lifted vertically to permit the passage of vessels; the portions of said bridge over the shallow parts of the main channel of said bay, about thirty-five hundred (3500) feet in length, to consist of deck steel girder spans supported on reinforced concrete pile bents; the portion on the westerly side of the main channel of said bay, being about five thousand (5000) feet in length, to consist of dredged embankment; the portion on the easterly side of said main channel about sixteen thousand (16,000) feet in length, to consist or dredged embankment and the remainder thereof, about four thousand (4000) feet, to consist of graded roadway; the whole structure to provide a paved roadway at least twenty-four (24) feet in clear width, protected by a suitable guard rail or rails, throughout its entire length; _____ over and by means of which there may traverse, pass and be carried and transported pedestrians, passengers, freight, locomotives, trucks, wagons, cars, or other vehicles, whether propelled by animals or power, also animals and livestock of every kind and nature, automobiles, electric current, telephone and telegraph messages and wires and cables for the transmission thereof, power wires and cables for the transmission thereof, water and pipes and conduits therefor, gas both natural and artificial, crude and refined oil, and derivatives and products thereof, and pipes and conduits for carrying the same.

Section 2. The said franchise guarantee shall, not later than twelve (12) months after the effective date of this ordinance, secure from the authority or authorities of the United States authorized by law to issue the same a permit for the construction of said toll bridge and, within said time, shall commence the erection and construction of the said toll bridge and shall complete the erection and construction thereof within three (3) years from and after the effective date of this ordinance, except as prevented by act of God, the public enemy or elements.

Section 3. The said franchise grantee shall have and is hereby granted the authority, right, privilege and franchise to enlarge the width of said toll bridge or any portion or portions thereof, at any time or times within twenty-five (25) years after the effective date of this ordinance, until the total width thereof, as so enlarged, shall not exceed sixty (60) feet;

Section 4. Before commencing the construction of the said toll bridge or any enlargements or additions thereto, the said franchise grantee shall file in the office of the clerk of the board of supervisors of the county of San Mateo, in the State of California, a copy of the plans and specifications for said work, together with a copy of each permit granted to said franchise grantee by the United States of America or by the State of California or any officer thereof.

Section 5. Before commencing the erection or construction of the said bridge, the said franchise grantee shall file, in the office of the board of supervisors of the county of San Mateo, a bond inuring to the benefit of said county of San Mateo and of persons crossing or desiring to cross the said toll bridge, in the penal sum of fifty thousand dollars ($50,000.00) with one or more sureties, and conditioned that the said toll bridge will be kept in good repair and condition and that the keeper thereof will faithfully comply with the laws of the State of California and with all legal orders of the board of supervisors of the county of San Mateo regulating the same, and pay all damages recovered against said franchise grantee by any persons injured or damaged by reason of delay at or defect in such bridge, or in any manner resulting from non-compliance with the laws or lawful orders regulating the said toll bridge. The said bond shall be annually renewed.

Section 6. There is hereby granted unto the said franchise grantee the authority, right and privilege to make all necessary, desirable or convenient excavations and fills in, to, near or adjacent to the said bridge and the approaches thereto, and to install, operate, and maintain, wherever necessary, desirable or convenient such power plant or plants, of whatsoever character or description, as may be necessary, desirable or convenient in erecting, construction, reconstructing, operating or maintaining the said toll bridge and the approaches thereto.

Section 7. No toll bridge or ferry shall be constructed, operated, maintained or established during the said period of fifty (50) years from and after the effective date of this ordinance, within one mile immediately above or below the toll bridge hereinabove described, unless the situation of a town or village, the crossing of a public highway or the intersection of some creek or ravine renders it necessary for public convenience.

Section 8. During the period of fifty (50) years from and after the effective date of this ordinance, the county of San Mateo will not erect, construct, own, hold, operate nor maintain any bridge from any part or place in said county of San Mateo across San Francisco Bay, without first purchasing, in the manner provided by section 2881 of the Political Code of the State of California, the toll bridge to be erected and constructed by the franchise grantee herein.

Section 9. The grantor hereof hereby finds and determines, as a matter of fact as a result of the hearing upon the application of the said franchise grantee and as a result of the consideration and examination of the facts, the sworn testimony of John Lyle Harrington, and the evidence adduced at said hearing, that the actual cost of erecting and constructing the toll bridge hereinabove described will be two million dollars ($2,000,000). In order that an income not exceeding fifteen per centum (15%) on said actual cost of constructing and erecting the said toll bridge, and such additional income as will provide for the annual cost of operation, maintenance, and amortization thereof, and taxes thereon, may be had and derived from the operation of said toll bridge, the following rates of tolls which the said franchise grantee is hereby authorized to charge and collect for the use of the said toll bridge, are hereby fixed:

For each person, 5 cents;

For each motorcycle, 15 cents;

For each tri-car, 20 cents;

For each passenger automobile of a capacity of two passengers or less, 20 cents;

For each passenger automobile of a capacity of more than two and not more than five passengers, 30 cents;

For each passenger automobile of a capacity of more than five and not more than seven passengers, 35 cents;

For each passenger automobile of a capacity of more than seven passengers, 75 cents;

For each trailer to a passenger automobile, 50 cents;

For team with vehicle of less than two tons copacity, 25 cents;

For team with vehicle of more than two and not more than four tons capacity, 50 cents;

For team with vehicle of more than four tons capacity, 75 cents;

For each trailer to animal-drawn vehicle, 50 cents;

For each truck of a capacity not exceeding one ton, 30 cents;

For each truck of a capacity exceeding one and not exceeding two tons, 40 cents;

For each truck of a capacity exceeding two and not exceeding three tons, 60 cents;

For each truck of a capacity exceeding three and not exceeding four tons, 80 cents;

For each truck of a capacity exceeding four and not exceeding six tons, $1.00;

For each truck of a capacity exceeding six and not exceeding ten tons, $1.25;

For each truck of a capacity in excess of ten tons, 12½ cents per ton of capacity;

For each trailer to a truck, three-fourths of the charge for the truck;

For each stage or bus, 75 cents;

For electric current used for power, heat or light, 50 cents per year per kilowatt capacity of and on each separate installation, plus 50 cents per kilowatt a year of current transmitted;

For each telephone message, one-half cent;

For each telegraph message, one cent;

The application of John Lyle Harrington, which application is referred to in the above ordinance, having been regularly made at the regular meeting of the board of supervisors of the county of San Mateo, State of California, held at ten o'clock in the forenoon on the seventeenth day of November, 1924, and the hearing of said application having been by the said board then regularly adjourned until the hour of ten o'clock in the forenoon on the nineteenth day of November, 1924, and, again, on said last mentioned date, regularly adjourned until the hour of ten o'clock in the forenoon on the twentieth day of November, 1924, the above ordinance was, on said last mentioned date, regularly passed and adopted by the board of supervisors of the county of San Mateo, State of California, by the following vote:

Ayes and in favor of the passage of said ordinance: T. L. Hickey, Rosalie M. Brown, John MacBain, Manuel Francis, C. V. Thompson.

Noes and against the passage of said ordinance: None.

Absent members not voting: None.

C. V. THOMPSON,
Chairman of the board of supervisors of the County of San Mateo, State of California.

[SEAL]

ELIZABETH M. KNEESE,
Clerk of the board of supervisors of the County of San Mateo, State of California.

(PUBLIC—No. 169—69TH CONGRESS)
(H. R. 8190)

An act authorizing the construction of a bridge across the Colorado River near Blythe, California. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of Congress is hereby granted to John Lyle Harrington, his heirs, legal representatives, and assigns, to construct, maintain, and operate a bridge and approaches thereto across the Colorado River, at a point suitable to the interests of navigation near the city of Blythe, California, in accordance with the provisions of the act entitled "An act to regulate the construction of bridges over navigable waters," approved March 23, 1906, and subject to the conditions and limitations contained in this act.

Sec. 2. There is hereby conferred upon the said John Lyle Harrington, his heirs, legal representatives, and assigns, all such rights and powers to enter upon lands and to acquire, condemn, appropriate, occupy, possess, and use real estate, and other property needed for the location, construction, operation and maintenance of such bridge and its approaches and terminals as are possessed by railroad corporations for railroad purposes, or by bridge corporations for bridge purposes in the state or states in which such real estate and other property are located, upon making just compensation therefor, to be ascertained and paid according to the laws of such state or states, and the proceedings therefor shall be the same as in the condemnation and expropriation of property in such state or states.

Sec. 3. The said John Lyle Harrington, his heirs, legal representatives, and assigns, are hereby authorized to fix and charge tolls for transit over such bridge, and the rates so fixed shall be the legal rates until changed by the Secretary of War under the authority contained in such act of March 23, 1906.

Sec. 4. After the date of completion of such bridge, as determined by the Secretary of War, either the State of California, the State of Arizona, any political subdivision of either of such states, within or adjoining which any part of such bridge is located, or any two or more of them jointly, may at any time acquire and take over all right, title and interest in such bridge and approaches, and interests in real property necessary therefor, by purchase, or by condemnation in accordance with the law of either of such states governing the acquisition of private property for public purposes by condemnation. If at any time after the expiration of twenty years after the completion of such bridge it is acquired by condemnation, the amount of damages or compensation to be allowed shall not include good will, going value, or prospective revenues or profits, but shall be limited to the sum of (1) the actual cost of constructing such bridge and approaches less a reasonable deduction for actual depreciation in respect of such bridge and approaches, (2) the actual cost of acquiring such interests in real property, (3) actual financing and promotion costs (not to exceed 10 per centum of the sum of the cost of construction of such bridge and approaches and the acquisition of such interests in real property), and (4) actual expenditures for necessary improvements.

Sec. 5. The said John Lyle Harrington, his heirs, legal representatives, and assigns shall within ninety days after the completion of such bridge file with the Secretary of War a sworn itemized statement showing the actual original cost of constructing such bridge and approaches, including the actual cost of acquiring interests in real property and actual financing and promotion costs. Within three years after the completion of such bridge, the Secretary of War may investigate the actual cost of such bridge, and for such purpose the said John Lyle Harrington, his heirs, legal representatives, and assigns, shall make available to the Secretary of War all of his records in connection with the financing and construction thereof. The findings of the Secretary of War as to such actual original cost shall be conclusive, subject only to review in a court of equity for fraud or gross mistake.

Sec. 6. If such bridge shall be taken over and acquired by the states or political subdivisions thereof under the provisions of section 4 of this act, the same may thereafter be operated as a toll bridge; in fixing the rates of toll to be charged for the use of such bridge, the same shall be so adjusted as to provide as far as possible a sufficient fund to pay for the cost of maintaining, repairing, and operating the bridge and its approaches, to pay an adequate return on the cost thereof, and to provide a sinking fund sufficient to amortize the amount paid therefor within a period of not to exceed thirty years from the date of acquiring the same. After a sinking fund sufficient to pay the cost of acquiring such bridge and its approaches shall have been provided, the bridge shall thereafter be maintained and operated free of tolls or the rates of toll shall be so adjusted as to provide a fund not to exceed the amount necessary for the proper care, repair, maintenance, and operation of the bridge and its approaches. An accurate record of the amount paid for acquiring the bridge and its approaches, the expenditures for operation, repairing, and maintaining the same, and of the daily tolls collected shall be kept and shall be available for the information of all persons interested.

Sec. 7. The right to sell, assign, transfer, and mortgage all the rights, powers, and the privileges conferred by this act is hereby granted to the said John Lyle Harrington, his heirs, legal representatives, and assigns, and any corporation to which such rights, powers, and privileges may be sold, assigned or transferred, or which shall acquire the same by mortgage foreclosure or otherwise, is hereby authorized and empowered to exercise the same as fully as though conferred herein directly upon such corporation.

Sec. 8. The right to alter, amend, or repeal this act is hereby expressly reserved.

Approved May 3, 1926.

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STATE OF CALIFORNIA

REPORT

OF THE

Joint Legislative Committee

OF THE

Senate and Assembly

Appointed to Investigate and Study Various Problems, and to Make Recommendations Concerning Enactment, Changes and Enforcement of Laws Relating to the Use and Regulation of Vehicles on the Public Highways, and as to the Advisability of the Adoption of a Law Requiring Financial Security on the Part of Persons Operating Motor Vehicles upon the Highways of This State.

SUBMITTED TO THE LEGISLATURE
OF THE STATE OF CALIFORNIA

JANUARY, 1929

65438

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LETTER OF TRANSMITTAL

To the members of the Legislature, State of California, Forty-eighth Session, 1929:

The Joint Legislative Committee, appointed by the Senate and the Assembly of the State of California at the session of 1927 to investigate and make recommendations concerning certain problems relating to the use and regulation of motor vehicles on the highways of the state, herewith presents its report.

January, 1929.

EDGAR C. LEVEY, Chairman.
C. C. BAKER.
HARRY F. SEWELL.
HARRY A. CHAMBERLIN.
TALLANT TUBBS.
M. J. MCDONOUGH.

INTRODUCTORY

THE JOINT LEGISLATIVE COMMITTEE

The authority of this committee, the scope of its investigations, and the purposes of its recommendations, are set forth in the following resolution of the Legislature of the State of California.

ASSEMBLY CONCURRENT RESOLUTION No. 19

Providing for the creation of a joint committee of the Senate and Assembly to investigate traffic conditions in the State of California and the question of safety and prevention of accidents in relation thereto; to prepare and make recommendations concerning changes in existing laws, and the enactment and/or enforcement of laws relating to the use and operation of vehicles on the public highways, and to prepare and submit with supporting facts, ascertained, a report as to the advisability of the adoption of a law requiring financial security on the part of persons operating motor vehicles upon the highways of this state and making appropriation to meet the expenses of said committee necessarily incurred in said work.

WHEREAS, There has been a great increase in the number of motor vehicles used and operated upon the highways of the State of California, resulting in an abnormal increase in the number of accidents resulting in the injury to persons and property; and

WHEREAS, No adequate method seems to have been devised for the enforcement of the safety provision of the existing laws relating to the use and operation of motor vehicles on the highway; and

WHEREAS, Any revision of the laws relating to such use and operation of such vehicles should involve consideration of the advisability of enacting a law requiring owners or operators of such vehicles to give financial security for the satisfaction of judgments arising out of the use and operation of such vehicles. Now, therefore, be it

Resolved by the Assembly of the State of California, the Senate concurring, That there is hereby created a joint committee of the Assembly and Senate to consist of three members of the Assembly to be appointed by the speaker of the Assembly, one of whom shall be the speaker of the Assembly, and three members of the Senate to be appointed by the president of the Senate, one of whom may be the president of the Senate.

It will be the duty of said committee to investigate the adequacy of the facilities for the enforcement of existing laws relating to the use and operation of vehicles on the highways of this state, and the advisability of establishing some system of enforcement of all laws relating to the safe operation of such vehicles, and to make recommendations concerning the advisability of amendments to existing laws, if in the discretion of the committee deemed necessary, and, if the committee reports in favor of the adoption of any specific law, it should include in its report or plan recommended the measures which in its judgment should be enacted.

It shall also be the duty of said committee to study the advisability of requiring owners or operators of motor vehicles on the public highways to give some form of security for the payment of judgments, for which said owner or operator may be liable, arising out of the use and operation of such vehicles on the public highways. In making this study the said committee shall carefully consider the laws and systems enacted in other states and countries, and the effect that any such systems would have in the State of California on account of the unusual conditions arising in this state due to many thousands of visitors coming into this state every year by means of motor vehicle transportation. Said committee is to make its report to the Legislature at its next session, and for the purpose of studying the questions involved and the preparation of its report, it shall be given the assistance of the chief of the division of motor vehicles and shall have the right to call for any statistics or available data of said division.

The members of said committee shall receive no compensation for such services other than their official salaries, but shall be reimbursed for their actual expenses necessarily incurred hereunder not exceeding the amount hereinafter specified. Such committee is hereby authorized to employ competent clerical or other help to assist in the preparation and compiling of all data ascertained, including the making of the final report. The said committee may also employ an executive secretary, whose duties shall be to work under the direction and control of said committee, and to that end the said committee may send said executive secretary to any state of the union to make a first-hand investigation of conditions there. The said committee shall be provided with quarters in the state building at San Francisco if such quarters are available, but if said quarters are not available, said committee may procure quarters in the city of San Francisco for its headquarters.

The expense of such clerical and other help and of the executive secretary and of such quarters, and for other necessary expenses of the committee, shall be passed upon and fixed by the committee subject, however, that the total of said expenses and costs shall not exceed the amount hereinafter specified.

The expenses thus incurred by said committee under the authority hereof shall be payable out of the moneys heretofore or hereafter appropriated for the contingent expenses for the Senate and Assembly at this session of the Legislature, payable one-half from the contingent fund of the Senate and one-half from the contingent fund of the Assembly, but not exceeding the sum of seven thousand five hundred dollars in all, which sum, or so much thereof as may be necessary, so composed, is hereby set apart, reserved and appropriated out of said respective contingent funds for the purposes aforesaid to be disbursed from time to time by controller's warrants to be drawn against said contingent funds upon the written orders of the chairman of said joint committee. And be it further

Resolved, That the said committee be instructed to have prepared its report not later than the first day of December, A. D. 1928, and that a copy of said report be not later than said date transmitted to the governor of the state in order that he may make such comment thereon as he may deem appropriate to the Legislature at its next ensuing session.

This resolution was passed by the Assembly on March 16, 1927, and by the Senate on April 6, 1927.

In accordance with its terms, the President of the Senate appointed as members of the committee Senators C. C. Baker of Salinas, Harry A. Chamberlin of Los Angeles and Tallant Tubbs of San Francisco; and the Speaker of the Assembly, Hon. Edgar C. Levey of San Francisco, who was designated by the resolution as ex officio member, appointed Assemblymen Harry F. Sewell of Whittier and M. J. McDonough of Oakland to serve on the committee.

REPORT OF THE COMMITTEE*

The Joint Legislative Committee organized with Speaker of the Assembly Edgar C. Levey as chairman, Senator C. C. Baker as vice chairman, and Assemblyman Harry F. Sewell as secretary.

During the course of its investigations, public hearings were held at San Francisco and Los Angeles; and helpful data were supplied to the committee from many and varied sources.

In this connection the committee wishes to express its sincere appreciation of the assistance rendered to it by many persons and organizations. Almost without exception, public and private agencies have responded to the full extent of their ability, and in many cases at the cost of extended research, to the committee's requests for information. Deserving of special mention are the authorities of hospitals and other institutions, clubs, fraternal societies, insurance bureaus, state and federal administrative offices, police departments, and public officials, notably the district attorneys, county clerks, sheriffs and coroners, from whom valuable data were received.

The work of the committee has been greatly facilitated by reports and briefs filed with it by interested organizations. Of particular value in this regard were the joint briefs submitted by the two motorists' clubs, the California State Automobile Association and the Automobile Club of Southern California, the studies and statistical analyses by the latter body relating to the thirteen southern counties of the state supplying the most complete and authentic information of its kind that the Committee was able to procure.

The Bureau of Vital Statistics of the Department of Health, ever responsive, was particularly and especially helpful at all times in the gathering of statistics; and the Industrial Accident Commission also offered ready assistance.

The committee acknowledges indebtedness to the reports of the National Conference on Street and Highway Safety, and to its chairman, the Honorable Herbert Hoover; to the Chamber of Commerce of the United States; to the National Safety Council; to the American Road Builders' Association; to the American Automobile Association; to the American Motorists' Association; to the Casualty Committee of California, and to the San Francisco Traffic Survey Commission.

The committee owes its thanks also to the State Insurance Department of Massachussetts, for information relative to the automobile insurance law in force in that state; to the Commissioner of Motor Vehicles of Connecticut for the *Fourth Study* and other data of accidents and law enforcement; and to the Maryland State Roads Commission and Commissioner of Motor Vehicles for much valuable aid. And to the many others who have assisted in various ways, the committee wishes to acknowledge its obligation.

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* The committee acknowledges its indebtedness to John N. Mackall, Esq., Chairman and Chief Engineer of the Maryland State Roads Commission, for the loan of Mr. George W. White, Jr., who as the committee's executive officer and traffic expert collated its data and supervised the preparation of its report.

SCOPE OF INVESTIGATION

The investigation submitted to this committee by the Legislature, as set forth in the joint resolution, is divided under three general heads:

I. To investigate
   (a) traffic conditions in the State of California, and
   (b) the question of safety and the prevention of accidents.

II. To prepare and make recommendations for
   (a) changes in existing laws, and
   (b) the enactment and/or enforcement of laws relating to the use and operation of vehicles on the public highways.

III. To prepare and submit a report as to the advisability of the adoption of a law requiring financial security on the part of persons operating motor vehicles upon the highways of this state.

As is immediately apparent, the scope of the proposed investigation is broad in the extreme. Into one or another of the divisions indicated above, and particularly the first, will come the many ramifications of the widespreading problem created by the motor vehicle.

Obviously, the brief space of time and the very limited facilities at the disposal of the committee have precluded investigation of the problem in all its phases. Such investigation could be fruitfully conducted only through a scientific study carried on over a term of years with practically unlimited facilities and adequate appropriation of funds. It has, of course, been possible for the committee to give itself to a consideration of the problem as a whole only in a more general way, and to treat more in particular only its vitally important aspects.

By force of circumstances, therefore, the committee has been constrained to confine its study of accidents to those involving death or injury to persons; and even thus restricted, its consideration of the subject has been qualified and limited in many directions, but especially by the incompleteness or nonexistence of records, and a paucity of other data.

The committee does not believe that a complete solution of the problem is in sight, but it is convinced that great progress could be made along the line of accident prevention in the State of California, if more were known about motor vehicle accidents and their causes. The committee views the problem as a changing one, and is convinced that the need is for continuing rather than temporary or intermittent study.

Mindful of these conclusions, the committee has undertaken to recommend only such legislation as seems warranted by known conditions. Numerous proposals, some of them bizarre and grotesque, have been received, and the committee has been urged to put California in the forefront of the states with daring and novel legislation; but it believes that conservative progress is preferable to costly experimentation with untried and doubtful cure-alls. In this decision, and in its particular recommendations, the committee has followed in considerable measure the findings of the National Conference on Street and Highway Safety, called together from every state in the Union by California's most distinguished son, the Honorable Herbert Hoover, in 1924 and

again in 1926 for the study of traffic problems, under the auspices and with the facilities and resources of the United States Department of Commerce.

That this report is so completely in accord with the principles laid down by that conference is a source of no small gratification to this committee; and it feels that it can do no better than preface its specific recommendations with the address made by Mr. Hoover, as chairman of the conference, at its second convening in March, 1926.

As the work of that conference is the accepted point of departure for the safety work being undertaken throughout the country; and as there has nowhere been found a more comprehensive and concise statement of the problem created by the motor vehicle, nor a clearer indication of the means to a solution of that problem, than is contained in Mr. Hoover's address, the committee makes no apology for presenting here his remarks in their entirety.

Mr. Hoover's address:

"The purpose and problem of this conference is to devise and recommend measures which will reduce the traffic accidents in the country. With 23,900 persons killed and approximately 600,000 injured last year, the importance of this subject needs no emphasis.

Furthermore, the presence at this conference of the official delegates appointed by the governors of 43 states, delegates of all the voluntary organizations in the country given to promotion of greater traffic safety, including traffic and police officials and representatives of industries concerned, amounting to nearly 1000 delegates gathered here, is proof of the seriousness of the question.

It is just a little over fifteen months since we met in this room to consider the reports of the eight committees of the First National Conference on Street and Highway Safety and weave them together into a final report of the conference itself. In this report you made certain recommendations with regard to legislation, administration and regulation, cooperative work and future activities involved in a national street and highway accident prevention program. At the same time, realizing as we all did, that the work of this conference was in no wise completed, you requested that I call a second conference after about a year and that in the interim the necessary committee work be carried on.

The committees of the first conference rendered an invaluable service in building the foundation for the work which has been done during the past year and which will be presented to you at this conference. Theirs was the work of pioneers. They were charged with the duty of making a preliminary survey of the street and highway situation, of studying present-day methods of traffic control, of evaluating the factor of construction and engineering, of making an examination of the relation of city planning and zoning to street and highway hazards, of investigating the entire question of automobile insurance and its relation to accident prevention, and of making recommendations with regard to the education of the public and the construction of the motor vehicle itself.

The reports of these committees are in as great demand today as they were a year ago. They have become a definite part of the literature which is guiding city and state officials throughout the United States in their efforts to bring about better traffic conditions in their respective communities.

You will recollect that the conference last year enlarged the Public Relations Committee and instructed it to act as a steering committee for formulation of the work of this conference by the creation of new committees to investigate and make recommendations as to special phases developed by the former committees and adopted by the last conference. Six of the eight committees of the last conference had practically completed their work and said what seemed to them to be the last word for the time being on their respective subjects. Another committee, which was Committee No. 1 on Statistics, was engaged in a work which because of its nature is never done. We, therefore, continued this committee and it presents to this conference a further report as of January 1, 1926.

The outstanding feature in the reports of all our committees last year and in the decisions of the conference itself was the lack of uniformity in our traffic laws and

regulations and the failure of many communities to benefit by the experience of others—all of which has a large responsibility in the causes of accidents.

In result of your recommendations last year we appointed a Committee on Uniformity of Laws and Regulations, and requested it to prepare for submission to this conference a model motor vehicle code which would be so drafted that it might act as a guide to the different states.

At the request of the conference we also appointed a Committee on Enforcement to study the entire question of enforcement procedure and to report if possible on the best method in vogue for bringing about obedience to the motor vehicle law. After all, laws are of little value if they are not or can not be properly enforced, and it is my belief that much of the solution of the present high accident-rate on our city streets and rural highways lies in the enforcement of the law by the police and by properly organized traffic courts.

Last year the Committee on Statistics pleaded for adequate uniform methods of accident reporting and stated that very little is known about the causes of accidents. It renews its plea this year, with emphasis. It seems that too often the cause of the accident which is reported is either not a cause at all or is simply a collateral or contributing cause, and that very little is known about fundamental causes. In response to the wish of the last conference, a Committee on Causes of Accidents has given deep study to this subject.

Again as requested by the conference last year, we appointed a Committee on Metropolitan Traffic Facilities to study the causes of congestion, the costs of congestion, the methods of relief. It must not be forgotten that if we are to find a permanent solution for the problem of traffic accidents we must at the same time discover a permanent solution for the problem of traffic itself.

The members of these six committees have given an extraordinary amount of time and intelligent effort in presentation to you of their reports.

The Committee on Statistics in its discussion of the trend of street and highway accidents presents a picture which is not very encouraging, although it has some bright spots. It tells us that while the total number of fatalities and possibly the number of serious personal injury accidents is increasing numerically, the speed of increase has been dropping for the past two years and that perhaps we can look forward to a gradual decrease in the total number of accidents. I would like to feel and I do feel that this improvement—which is significant when one considers the tremendous increase in motor vehicle registrations—is due to the work of the many bodies which are represented at this conference. I am told that if traffic fatalities had continued to increase during 1924 and 1925 at the same average rate that they increased from 1919 to 1923, there are over 6000 persons living today who would have lost their lives during those two years. All this is hypothetical, but it is encouragement to continue in the fight.

You have had placed before you a model motor vehicle code consisting of three suggested laws which, if adopted by all of the states, will bring about uniformity of laws and regulations. I consider this to be perhaps the outstanding concrete accomplishment of the two years of work of the Conference on Street and Highway Safety. In making this statement I do not depreciate in any way the work of any of the other committees. Their work is the foundation for it. This code is largely based on the results of their work and could hardly have been designed in a manner which seems to be so satisfactory to all groups had it not been for their services. The committee is headed by one of the Nation's most distinguished lawyers. He has had in the personnel of his committee well-known lawyers, engineers, state and city officials, and representatives of practically all of the groups affected by the traffic situation. The committee has worked hard. It has had the benefit of the invaluable assistance of the National Conference of Commissioners on Uniform State Laws. Its draftsman is a man of long experience in motor vehicle legislation. It is my belief that in presenting the three suggested laws which make up this code to the various state legislatures throughout the United States this conference is making a contribution to the effort to save lives and human suffering which can never be measured in dollars and cents.

The need for uniformity of laws as between states and uniformity of traffic ordinances as between cities of the same state is to me so obvious as to hardly need any elaborate discussion.

Automobile regulation may be divided into two general types: Local police control unassisted by proper state motor vehicle law, and local police assisted by such a law. The question has sometimes been asked as to whether there is any evidence that motor vehicle law of the type recommended by the Committee on Uniformity of Laws and

Regulations is actually productive of a decrease in accidents. It goes without saying that in a field involving so many factors there is a great difficulty in determining the exact results of such legislation. I have, however, within the last thirty days received the results of a study of this subject, which indicate that the accident hazard in the states having modern motor vehicle legislation is less by some 25 to 30 per cent than it is in other states which do not have such vehicle legislation. These figures appear to be supported by the data gained from the experience of automobile insurance companies.

It is gratifying to note the recent report of improvement in the accident situation in the great state of New York. During the year since its new automobile law went into effect this state has recorded a decrease of 10 per cent in automobile accidents as compared with the preceding year. Contrasted with a nationwide increase of apparently five per cent or more during the same period the reduction of New York state seems to constitute another indication of the value of motor vehicle laws embodying the principles recommended by your Committee on Uniformity of Laws and Regulations.

But the mere acquisition of uniformity of motor vehicle laws is by no means sufficient. These laws can not be considered to have any particular value simply because they are written on the statute books. They must be enforced. It seems to me, therefore, that a careful study of the report of the Committee on Enforcement is almost if not entirely as important as a careful study of the report of the Committee on Uniformity of Laws and Regulations. Without drastic enforcement, without certain and sure punishment for the wilful violator of the law, without some method of court procedure by means of which the criminally reckless, the negligent and the incompetent can be driven from the use of the streets and highways by means of the operation of that law, the time which has been occupied in its drafting has been wasted.

The Committee on Enforcement has presented to you a report which is the result of a careful study of the most effective means for the prevention of traffic violations. It seems to me that you can do no better than to lend your best efforts to persuading the courts, the police, and traffic authorities generally throughout the country that except in those cases where there may be extenuating or unusual circumstances they adopt procedures which will insure certain and drastic penalties for the deliberate violator of the traffic laws and the rights of others.

The Committee on Causes of Accidents demonstrates very clearly the outstanding fact that very little is known about what causes a particular motor vehicle accident. It seems to be impossible at this time to even evaluate with any degree of accuracy the human and the mechanical or physical factors which are involved in every accident. The outstanding feature of the report of this committee is a plea for exhaustive and extended research work on the part of some organization which may be particularly fitted for that purpose.

It seems to me that this is fundamental. We are setting out to put a stop to accidents without apparently knowing the real fundamental cause of that large area of accidents which lie outside the field of sheer recklessness and negligence and so it might be said that even with adequate and proper uniform laws and with a method of procedure which would insure the enforcement of those laws accidents will continue until we can discover this elusive and mysterious cause of the accident.

The question of metropolitan traffic facilities leads us into an entirely new field, but one which is closely allied with accidents and accident prevention. After all, are we not facing two problems which are interlocking? We started out to solve the problem of traffic accidents. We have passed through the door of the problem of urban transportation.

Urban transportation does not mean to me simply the question of facilities for the movement of great masses of people living in communities. Transportation facilities include everything from pedestrianism to steam railroads, the intermediate units being the private automobile, the rented or drive-it-yourself car, the taxicab, the motor bus, the street railway, and the elevated and subway lines.

Are we not faced here with a great problem of the proper coordination of a city's transportation facilities? Is it not true that if we solve that problem we will solve to a very large degree the problem of congestion, and will not this solution in turn contribute to the solution of the problem of accident prevention?

It seems to me that here again we are faced with the need for exhaustive and intensive research work. I am impressed with the thought that it is high time that some agency present to the public a scheme for urban transportation which will include all of these transportation units and which, because of some scientific scheme

of coordinating the various units, will increase the use which we can obtain from our present streets and highways.

The Committee on Metropolitan Traffic Facilities has presented to you a startling picture of the material losses resulting from congestion and inadequate facilities. It has stated that these great annual losses constitute a most conspicuous and widespread economic waste, reaching every individual not only through the menace to life and safety, but also through increased costs of nearly every necessity of life. It has devoted its report very largely to the need of a program for improvement of traffic facilities and methods of organization for the carrying out of such a program. The magnitude and ramifications of this work are such as to deserve not only the careful consideration but the active assistance and cooperation of every citizen of every community in this country.

These are the thoughts which I wish to leave with you as you take up your consideration of the various reports and recommendations of your committees. I wish to say again, as I said to the last conference, that after all the streets and facilities belong to all of the people and to no one special class, and if the result of this conference makes them just a bit more safe for all of the people it will have earned the thanks of the entire nation. I note with a great deal of satisfaction the response from the governors of the various states to the request of President Coolidge that official delegations representing their respective states be sent to this conference. This problem is not a problem to be solved by individual cities or even individual states, without regard to the conditions existing in other cities and other states. It is, after all, intellectually an interstate problem, yet one which must be solved materially and actually by the individual states acting in concert and not by the federal government or by some establishment set up by the federal government.

PART I

TRAFFIC CONDITIONS AND ACCIDENT PREVENTION IN CALIFORNIA

I

TRAFFIC CONDITIONS AND ACCIDENT PREVENTION IN CALIFORNIA

THE ACCIDENT SITUATION

Motor vehicle accidents in California are at present exacting a toll of five deaths for every day in the year. The number of persons injured in such accidents is conservatively put at 74 per day. Estimates for the state for the year 1928, based on reports for the first eleven months, are

Killed	1,850
Injured	27,000

While these figures are only estimates, it is believed that they mark with reasonable approximation the outlines of a situation which must be bettered.

When, in addition, the increase of casualties from year to year, as indicated by the figures for fatalities[1] furnished by the Bureau of Vital Statistics and given in Table 1, are taken into consideration, the condition is revealed as one which is steadily becoming more serious. The percentage of increase in deaths from this cause is noted for contrast with the 15 per cent rate of increase in the state's population during the same period.

TABLE 1

Deaths from Automobile Accidents in California

Year	*Deaths**	*Deaths†*
1922	953	1,085
1923	1,223	1,413
1924	1,232	1,364
1925	1,329	1,484
1926	1,449	1,623
1927	1,619	1,782
Increase over 1922	70%	64%

* Not including deaths in collisions with heavier vehicles.
† Including deaths in collisions with heavier vehicles.

Additional light is thrown on the urgent character of the problem by noting the relative position held by automobile accidents among the most frequent causes of death in California. In 1926, the latest year for which the figures are in hand, the motor vehicle, as shown by Table 2, stood eighth on the list, and is clearly outranked by only five of the other causes.

[1] It has not been possible to secure for the entire state dependable statistics of injuries resulting from automobile accidents; but it may be borne in mind while persuing the following pages that injury cases appear to maintain fairly evenly a ratio to fatalities of 15 to 1.

TABLE 2

Most Frequent Causes of Death in California in 1926*

Cause	*Deaths*
Heart disease	10,651
Tuberculosis	5,794
Cancer	5,638
Cerebral hemorrhage	4,050
Chronic nephritis	4,011
Bronchial pneumonia	1,680
Lobar pneumonia	1,656
Automobile accidents	1,623

* By courtesy of the Bureau of Vital Statistics.

Again, considering only the accidental deaths occurring in the state, those caused by motor vehicles far outnumber any other group, and constitute 34 per cent of the total. There are now more than twice as many deaths per year from automobile accidents as result from all industrial accidents in the state, the respective figures for the past six years being given in Table 3.

TABLE 3

Deaths from Industrial and Automobile Accidents

Year	*Industrial**	*Automobile*
1922	708	1,085
1923	716	1,413
1924	645	1,364
1925	677	1,484
1926	748	1,623
1927	714	1,782

* From Industrial Accident Commission.

It will be observed that while the number of deaths from industrial accidents was held practically at a standstill, despite the large industrial development and the great increase in machinery use during these six years, the number of deaths from automobile accidents grew in the same period by more than 64 per cent; by 70 per cent, if collisions with street cars and trains are excluded.

The relation in which the motor vehicle stands to other causes of accidental death in the state is shown in Table 4.

TABLE 4

Accidental Death Causes in California

Cause	*1925*	*1926*	*1927*
Poisoning	124	146	169
Burns	294	300	369
Absorption of gas	99	106	111
Drowning	327	407	398
Fire arms	112	103	113
Electricity	82	58	61
Railway trains *	188	212	192
Street cars *	65	55	51
Motor vehicles	1,484	1,623	1,782
Other vehicles	197	86	74
Animals	40	23	
Industrial accidents	677	748	714
All other causes	869	936	1,040
Totals	4,558	4,803	5,074

* Motor vehicles not involved

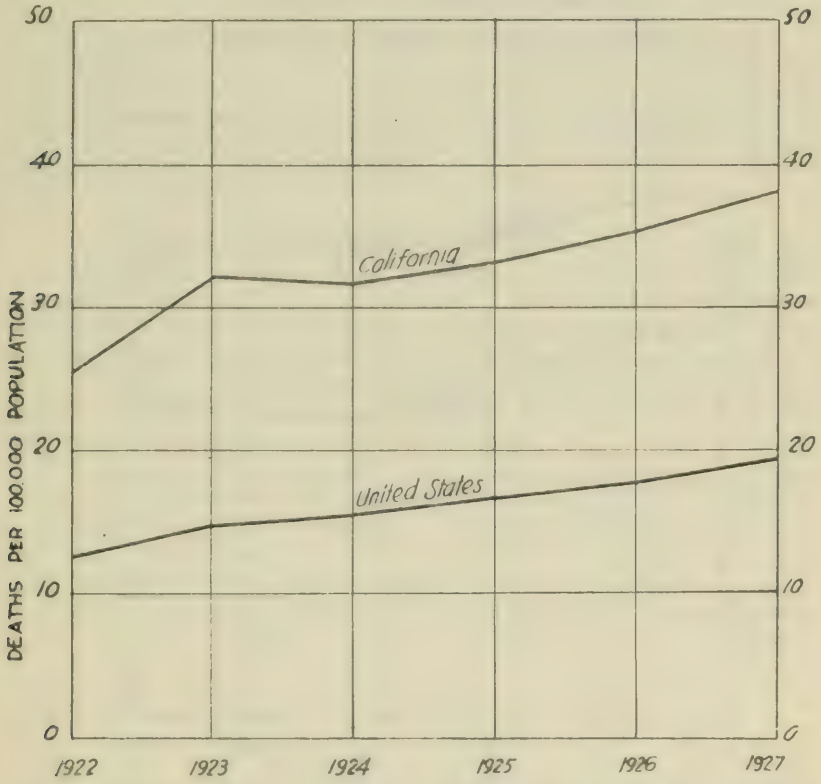
Here again it is to be noted, not only that automobiles cause one-third of all accidental deaths, but also that they account for considerably more than half the entire increase each year in the total of all accidental deaths.

Not only is the situation deplorable in the light of the statistics for the state considered alone, but also in comparison with the nation as

CHART I

ANNUAL DEATH RATES PER 100,000 POPULATION FROM MOTOR VEHICLE ACCIDENTS

{EXCLUDING COLLISIONS WITH TRAINS AND STREET CARS}



a whole California makes a poor showing. As will be seen from Chart I and the figures of Table 5, the automobile death rate per 100,000 of population is twice as high for the state as for the United States, and has in the past six years increased from 25.8 to 38.2, as against an increase from 12.5 to 19.6 for the entire country.

TABLE 5

Motor Vehicle Deaths per 100,000 Population

	1922	*1923*	*1924*	*1925*	*1926*	*1927*
California	25.8	32.2	31.6	33.2	35.3	38.2
United States	12.5	14.9	15.7	17.0	17.9	19.6

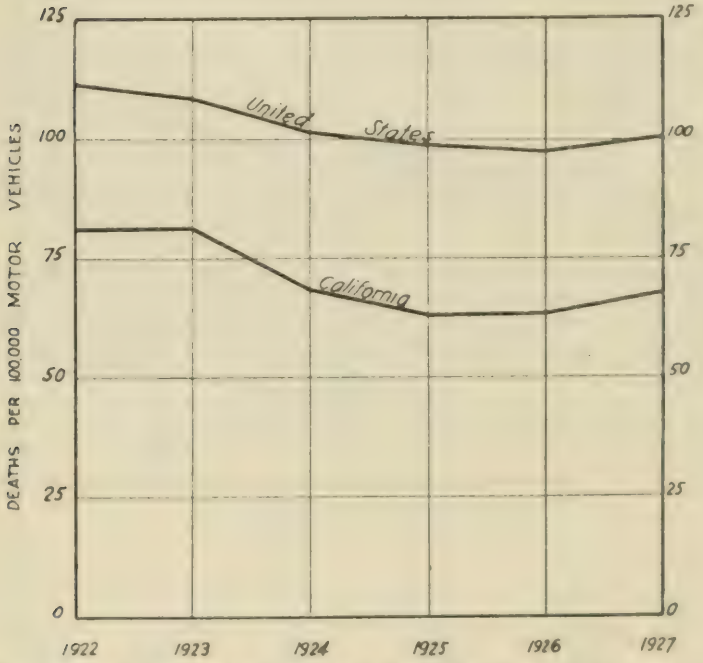
Increase—California, 12.4; United States, 7.1.

The one bright spot in the gloomy picture of the past years, and it is bright only by indirection, is found in the consideration that the increase of fatalities has not kept pace with the increase of motor vehicles upon the highways. While the number of automobiles registered* in the state rose from approximately a million in 1922 to approximately two millions in 1927, the automobile death rate per 100,000 registered motor vehicles declined from 82.1 to 67.5; showing both a lower number of deaths per 100,000 cars, and a greater decline in the

CHART II

ANNUAL DEATH RATES PER 100,000 MOTOR VEHICLES REGISTERED FROM MOTOR VEHICLE ACCIDENTS

{EXCLUDING COLLISIONS WITH TRAINS AND STREET CARS}



rate on this basis, than for the United States as a whole. This is graphically shown on Chart II, while the figures of the respective rates are given in Table 6.

TABLE 6

Automobile Deaths per 100,000 Registered Cars

	1922	1923	1924	1925	1926	1927
California	82.1	82.2	68.3	63.3	63.0	67.5
United States	111.6	108.5	101.2	98.4	95.5	100.5

* The committee has received from different sources conflicting sets of figures of registration, and regrets the lack of availability of authentic figures in this respect.

In conjunction with this consideration of the decline in the automobile death rate on the basis of the number of cars registered, is to be noted the corresponding increase in the number of traffic miles, or car miles traveled by motor vehicles, for each death resulting from accidents in which these vehicles are involved. This mileage* is shown to be as follows:

Year	*Traffic miles per auto death*
1924	7,376,267
1925	7,567,516
1926	8,464,584
1927	10,066,304

Any encouragement drawn from these considerations, however, is at best uncertain and unstable. The improvement is a negative one, rather apparent than real; for the whole value of the figures given is derived from the circumstance that an additional motor vehicle put on the highway this year has so far failed to equal the record of killings established by the cars in operation last year.

ACCIDENT PREVENTION

California stands second only to New York in the number of its registered motor vehicles, and averages a car for every two persons in the state. Traffic concentrates chiefly about its two urban centers and there is exceptionally heavy travel on some half dozen main highways. There is also an enormous volume of commercial trucking carried; and the state is visited throughout the year by a vast number of tourists, who figure largely in the situation.

In the light of these conditions, the problem of accident prevention assumes an importance that can hardly be exaggerated. The usefulness of safety measures presses for consideration; and determination of their value and effectiveness in the prevention of motor vehicle accidents makes necessary a searching study of accident causes.

Even the most superficial survey of the accident situation establishes that safety measures are urgently required. That betterment of existing conditions may be expected to follow from their use is evidenced by the good results that have been attained through the employment of such means in other fields.

For a number of years the medical profession and state departments of health have fought with preventive measures many forms of disease, with the results that not alone has the alarming spread of these scourges been checked, but notable reduction has been achieved in the number of resulting deaths year by year, and through painstaking and persevering study the serious consequence of these diseases have been minimized.

By contrasting the increase in the death rate from motor vehicle accidents with the decline in the death rate from a group of ten

* From data furnished by the Bureau of Vital Statistics.

diseases* against which prevention has been practiced for several years, Table 7 emphasizes the good results that may be expected from understanding and persistent efforts for automobile accident prevention.

TABLE 7

Death Rates per 100,000 Population of Automobile Accidents and Ten Certain Diseases* in California

Year	*Automobile*	*Diseases*
1922	25.8	224.8
1923	32.2	226.6
1924	31.6	223.8
1925	33.2	200.9
1926	35.3	189.1
1927	38.2	184.2

* Typhoid fever, malaria, smallpox, scarlet fever, whooping cough, diphtheria, tuberculosis, diarrhea and enteritis (under 2 years), puerperal septicemia, puerperal albuminuria.

In like manner in the field of industry a continuing study of accident causes and circumstances, with an ever-widening application of preventive measures, has been productive of excellent results, both in checking the increase and reducing the number of accidents, and in lessening the seriousness of those that occur. Table 8 sets up the contrasting figures of the increasing rate of deaths from motor vehicle accidents and the declining rate for industrial accidents.*

TABLE 8

Death Rate per 100,000 Population of Automobile Accidents and Industrial Accidents in California

Year	*Automobile*	*Industrial*
1922	25.8	19.2
1923	32.2	18.8
1924	31.6	16.5
1925	33.2	16.8
1926	35.3	18.1
1927	38.2	16.9

Presenting the picture in a different way, Chart III depicts the alarming increase in the death rate from motor vehicle accidents as contrasted with the downward trend of the death rates from industrial accidents and the group of diseases above referred to.

The curve for automobile accidents will decline as, and only as, the study of their causes advances to knowledge that will result in intelligent selection and application of accident prevention measures; and the committee is convinced that until accident prevention is recognized as the essential principle that must underlie and guide all efforts for solution of the motor vehicle problem, neither lasting nor satisfactory results will be achieved.

Numerous comparisons of the kind can be adduced; but let one other suffice, that demonstrates the efficacy of accident study and prevention measures in direct relation to motor vehicle accidents. Collisions occur between automobiles and street cars; and street car companies from their study of the subject have enforced among their employees preventive measures that have resulted in a marked reduction of fatalities from this cause, as shown in Table 9, in contrast with the ever-increasing toll from other types of automobile accidents.

* Data from Industrial Accident Commission and Bureau of Vital Statistics.

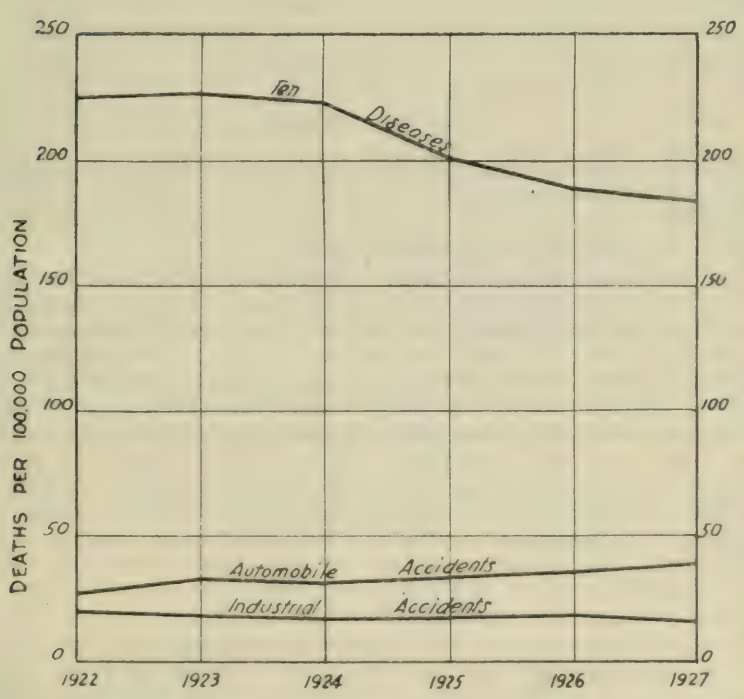
TABLE 9

Deaths in California from Street Car-Motor Vehicle Collisions and from All Other Motor Vehicle Accidents

Year	*Street car-motor vehicle collisions*	*All other automobile accidents*
1922	53	1,032
1923	68	1,345
1924	30	1,334
1925	37	1,447
1926	36	1,587
1927	27	1,755
	Decrease, 50 per cent	Increase, 70 per cent

CHART III

ANNUAL DEATH RATE IN CALIFORNIA PER 100,000 POPULATION FROM THREE CAUSES



Had motorists at the same time contributed their part by the exercise of greater carefulness, it is readily believable that there would have been few, if any, deaths to record as caused by collisions of this kind.

That this is so, and that credit for the betterment of the situation in this regard is not due to the motor vehicle operator, is shown, if evi-

dence be needed, by the corresponding record of fatalities resulting from collisions between automobiles and trains. In collisions of this type, the prevention of accident rests chiefly, if not solely, with the motorist; certainly the engineer of a train is ordinarily powerless to avert a collision.

What does the record show? How has the motorist met his responsibility? A glance at the figures given in Table 10 will tell the story. Deaths resulting from collisions between motor vehicle and train, in which only the motorist could employ preventive means, have more than kept pace with fatalities caused by all other automobile accidents; there is lacking the improvement shown in the preceding table, where despite the motorist's failure, the nonmotorist could, and patently did, apply preventive measures.

TABLE 10

Deaths in California from Motor Vehicle-Train Collisions and from All Other Automobile Accidents

Year	*Train-motor vehicle collisions*	*All other automobile accidents*
1922	79	1,006
1923	122	1,291
1924	102	1,262
1925	118	1,366
1926	138	1,485
1927	136	1,646
Increase	72 per cent	64 per cent

Most encouraging progress has been made wherever preventive methods have been studied and applied. That this will be true with regard to the motor vehicle problem can not be questioned; it has already been demonstrated time and again.

As noted elsewhere in this report, San Diego has for some time been enforcing vigorously a policy of accident investigation and law enforcement that has been consistently productive of most excellent results. In the same way, the safety campaigns that have, however spasmodically and without coordination, been conducted at different times and places in the state have invariably been rewarded with very noteworthy, albeit temporary, reduction of the toll exacted by automobile accidents.

It is the committee's conviction, however, that progressive and lasting improvement of existing conditions can not be effected without an understanding knowledge of such accidents and their causes and attendant circumstances to guide in the adoption of legislative and other preventive measures; and as the first of its recommendations, presented in Part III of this report, the committee proposes means for the acquisition of this essential knowledge.

Already something has been accomplished along this line by the studies, unfortunately unrelated, voluntarily undertaken by various agencies. By far the most worthwhile work of the kind, regarding the motor vehicle problem in this state, that has come to the notice of the committee in its investigation is comprised in the statistics prepared and submitted by the Automobile Club of Southern California. These statistics were compiled for the thirteen southern counties of the state, and cover a period of five years, from 1923 to 1927; and, with

one exception,[1] from no other source has the committee received more illuminating or more helpful data of the kind. All efforts, both by the committee and by others, to secure complementary statistics for the rest of the state have been unavailing, for reasons elsewhere set forth; and the committee makes use of some of the tables furnished by the club, which throw light on the types of motor vehicle accidents and the causes assigned for them, and the age groups in which their victims fall.

In Table 11 is given the analysis made by the club of the types of automobile accidents as they occur in the southern portion of the state:

TABLE 11*

Types of Fatal Motor Vehicle Accidents—California, Thirteen Southern Counties

Type of accident	*Number of fatalities*					
Collision between—	*1923*	*1924*	*1925*	*1926*	*1927*	*Total*
Auto and pedestrian	231	235	221	273	318	1,278
Truck and pedestrian	36	39	37	34	44	190
Motorcycle and pedestrian	3	3	3	3	--	12
Auto and auto	70	90	83	121	115	479
Auto and truck	32	34	42	44	65	217
Truck and truck	3	3	9	12	2	29
Motorcycle and motor vehicle	17	17	22	19	30	105
Motor vehicles and other vehicles	24	31	22	20	19	116
Motor vehicles and stationary objects	11	25	38	31	38	143
Electric railway and auto	60	37	48	43	51	239
Electric railway and truck	2	7	8	9	2	28
Electric railway and motorcycle	4	--	--	2	--	6
Steam railway and auto	35	29	42	49	47	202
Steam railway and truck	6	3	13	3	15	40
Steam railway and motorcycle	--	--	1	2	--	3
Motor vehicle overturned	142	130	179	166	173	790
Falls from motor vehicle	26	38	30	24	29	147
Totals	702	721	798	855	948	4,024

* From Public Safety Department, Automobile Club of Southern California.

Summarizing these numerous types by percentages under a half-dozen more general classifications, and setting them up against the corresponding figures for the nation as a whole, establishes the interesting comparisons of Table 12, in which will be noticed particularly the lower percentage in California of deaths due to automobile-pedestrian collisions, and the much higher comparative rate of deaths resulting from overturning of cars and from collisions between motor vehicles.

TABLE 12

Comparative Fatalities by Types of Accidents—California, Southern Counties, and United States

	Percentage of total deaths	
	California counties	*United States*
Motor vehicle vs. pedestrian	37	65
Motor vehicle vs. motor vehicle	21	13
Motor vehicle vs. railroad train	6	4
Motor vehicle vs. electric car	6	2
Motor vehicle vs. fixed object	4	5
Other motor vehicle accidents	26†	11

† 20 per cent of all deaths due to cars overturning.

[1] The committee has received most cordial and most efficient cooperation from Registrar L. E. Ross and his assistants in the Bureau of Vital Statistics of the State Department of Health. The records compiled by them have been, often most unexpectedly, a fruitful source of information, of which frequent use has been made in this report; and the committee wishes to testify its appreciation of the generous services and the unfailing good spirit of Mr. Ross and his staff.

As indicating the usefulness of such comparison in the study of accident prevention, the committee suggests the probable reasonableness of a tentative conclusion, from the showing of Table 12, that the education and regulation of pedestrians has advanced farther in California than in the country in general, while on the other hand the great disproportion of overturned cars, and the higher percentage of collisions between vehicles, seem to connote either that something is wrong with California driving—perhaps excessive speed—or that something is wrong with California roads. A way is thus opened, by even this incipient knowledge, for investigation and study that will undoubtedly lead to application of effective remedial and preventive measures.

The data from the automobile club discloses also the age-groups of the victims of motor vehicle accidents in the thirteen southern counties of the state. This information is shown in Table 13.

TABLE 13

Ages of Victims, Automobile Accident Fatalities—Thirteen Southern California Counties

	Number of fatalities						*Per cent*
Age-group	*1923*	*1924*	*1925*	*1926*	*1927*	*Total*	*of total*
Under 5 years	34	43	51	57	62	247	6.1
6 to 15 years	59	69	76	83	72	359	8.9
16 to 44 years	311	337	373	347	415	1,783	44.3
45 to 64 years	181	174	181	214	230	980	24.4
65 years and over	117	98	117	154	169	655	16.3
Totals	702	721	798	855	948	4,024	100.0

The figures of Table 13 emphasize two facts of particular importance in the study of accident prevention. First, the heaviest mortality rate per age-year found in the group between 16 and 44 years, in which it might naturally be expected that the rate would be lowest. Second, the large number of victims in the age-groups *under 5 years* and *over 64 years*, in both of which cases responsibility for avoidance of accident rests almost exclusively with the motorist, since the safety of the infant and of the aged pedestrian lies in his keeping.

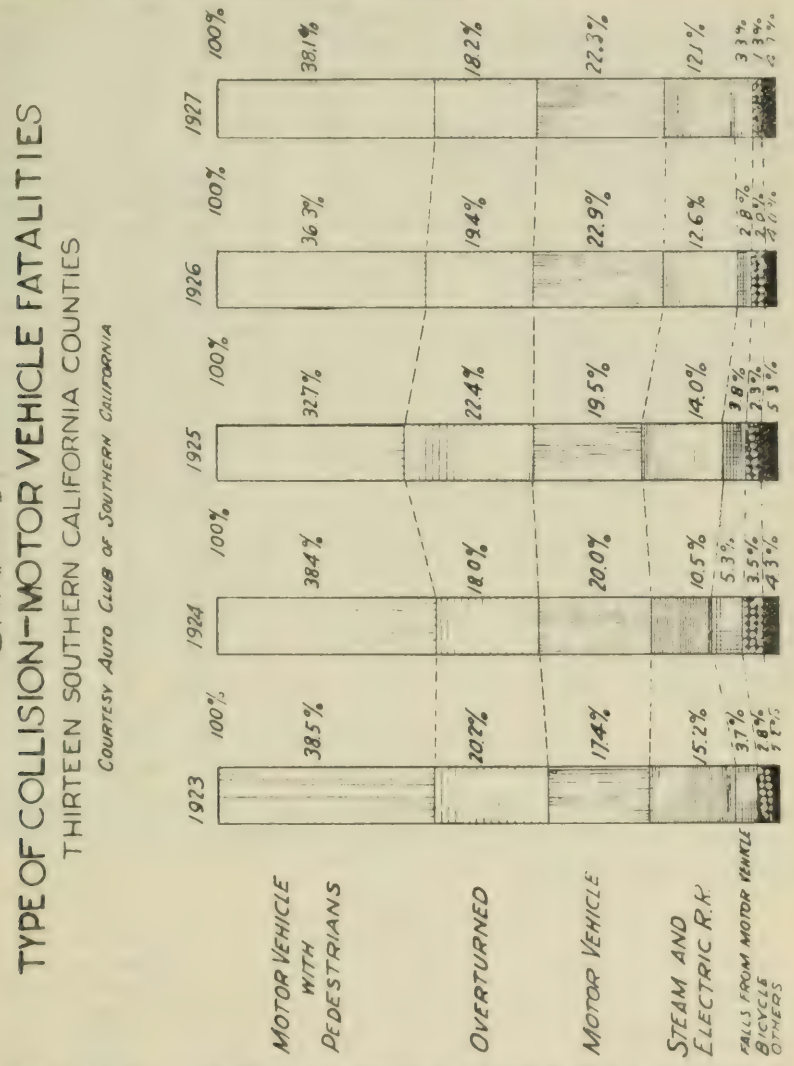
THE CAUSES OF ACCIDENTS

Effectiveness in the prevention of accidents is dependent upon knowledge of their causes; and of these causes little is now known.

Discussing this phase of the motor vehicle problem, President-elect Hoover said in his address quoted in the introduction to this report: "It seems to be impossible at this time to even evaluate with any degree of accuracy the human and the mechanical or physical factors which are involved in every accident. The outstanding feature of the report of this committee is a plea for exhaustive and extended research work on the part of some organization which may be particularly fitted for that purpose.

"It seems to me that this is fundamental. We are setting out to put a stop to accidents without apparently knowing the real fundamental cause of that large area of accidents which lie outside the field of sheer recklessness and negligence and so it might be said that even with adequate and proper uniform laws and with a method of procedure which would insure the enforcement of those laws accidents will continue until we can discover this elusive and mysterious cause of the accident."

Among the considerations included in the brief filed by the automobile club is a study of the apparent causes of the accidents previously tabulated: and the club's analysis of them under this aspect is given in Table 14, with a diagrammatic presentation on Chart IV.



The detailed listing of causes presented above may, for purposes of comparison, be consolidated under the headings shown below in Table 15, and it will then be seen that 58 per cent of the 4024 deaths under consideration were charged against the driver by reason of carelessness, recklessness, incompetence and intoxication, in the order named; while the pedestrian, mostly for carelessness, but partly for failure to think as swiftly as a motor car moved, was held accountable for 28 per cent.

TABLE 14*

Apparent Causes of Fatal Motor Vehicle Accidents—California, Thirteen Southern Counties

Apparent cause	*Number of deaths*					
	1923	*1924*	*1925*	*1926*	*1927*	*Total*
Crossing not at intersection	83	61	56	71	97	368
Crossing street carelessly	33	52	38	59	65	247
Confused by traffic	66	52	29	38	36	221
Falls in front of vehicle	18	3	7	13	14	55
Falls from vehicle	19	25	29	26	27	126
Improper riding on vehicle	11	17	7	13	12	60
Climbing or hitching on vehicle	--	--	--	--	--	--
Running or playing in street	26	51	68	46	51	242
Incompetent handling	144	85	64	78	71	442
Motorist's negligence at railway crossing	83	35	97	86	97	398
Speeding, 15-mile zone	6	15	21	77	86	205
Speeding, 20-mile zone	15	22	24	23	17	101
Speeding, over 20-mile zone	36	42	46	70	68	262
Intoxication	33	31	47	60	49	220
Failure to stop and render aid	7	6	14	11	24	62
Drove through safety zone	--	--	--	2	7	9
Cutting corner	1	4	--	3	1	9
Cutting in ahead	13	47	32	15	18	125
Right of way violated	17	36	53	47	51	204
Passing standing street car	--	8	7	1	3	19
Passing on wrong side	1	3	--	1	5	10
Driving on wrong side of road	15	24	23	27	48	137
Failure to signal	8	4	14	8	3	37
Backing	--	--	--	3	18	21
Skidding	29	42	41	31	24	167
Glaring lights	3	3	15	4	5	30
Weather conditions	2	7	9	1	7	26
No head light or no tail light	8	12	12	12	11	55
Defective equipment	17	22	17	20	12	88
Tire blowout	3	4	8	3	6	24
Defective highway	4	5	14	2	6	31
Driver asleep	1	3	6	4	9	23
Totals	702	721	798	855	948	4,024

*From Public Safety Department, Automobile Club of Southern California.

That the placing of blame in these cases may have its proper weight, it should be noted that it has been assigned in accordance with the findings of coroners in their inquests upon the deaths involved.

TABLE 15

Summary of Automobile Accident Causes—California, Thirteen Southern Counties

Cause	*Number of deaths*	*Per cent of total*
Careless driving	1,054	26.2
Speeding or recklessness	568	14.1
Incompetence	442	11.0
Intoxication	220	5.5
Careless pedestrian	615	15.3
Confused pedestrian	276	6.9
Playing in street	242	6.0
Falls from vehicle	126	3.1
Defective equipment	197	4.9
Other causes	284	7.0
Totals	4,024	100.0

Carrying farther its study of the causes and attendant circumstances of the accidents under consideration, the automobile club classified the apparent causes in their relation to the ages of the victims, with the results shown in Table 16.

TABLE 16*

Fatal Motor Vehicle Accidents, 1923–1927—Classification of Apparent Causes by Age Groups—California, Thirteen Southern Counties

Apparent cause	*Ages*					
	Under 5 years	*6–15*	*16–44*	*45–64*	*65 & over*	*Total*
Crossing not at intersection	13	28	50	128	149	368
Crossing street carelessly	9	15	48	75	100	247
Confused by traffic	3	4	37	73	104	221
Falls in front of vehicle	9	19	12	8	7	55
Falls from vehicle	7	19	67	27	6	126
Improper riding on vehicle	3	27	17	9	4	60
Climbing or hitching on vehicle	---	---	---	---	---	---
Running or playing in street	120	117	3	1	1	242
Incompetent handling	8	23	247	115	49	442
Motorist's negligence at railway crossing	9	23	216	117	33	398
Speeding, 15-mile zone	9	10	114	44	28	205
Speeding, 20-mile zone	1	2	68	23	7	101
Speeding, over 20-mile zone	5	8	185	57	7	262
Intoxication	2	6	149	48	15	220
Failure to stop and render aid	1	5	19	20	17	62
Drove through safety zone	1	---	2	1	5	9
Cutting corner	---	4	3	1	1	9
Cutting in ahead	4	10	66	30	15	125
Right of way violated	13	12	94	48	37	204
Passing standing street car	---	1	7	6	5	19
Passing on wrong side	---	---	7	3	---	10
Driving on wrong side of road	7	2	91	25	12	137
Failure to signal	2	5	16	7	7	37
Backing	10	1	3	4	3	21
Skidding	5	6	103	43	10	167
Glaring lights	1	1	13	9	6	30
Weather conditions	1	1	14	9	3	26
No head light or no tail light	---	4	33	14	4	55
Defective equipment	4	5	46	23	10	88
Tire blow-out	1	1	14	5	3	24
Defective highway	---	1	22	4	4	31
Driver asleep	---	---	17	3	3	23
Totals	247	359	1,783	980	655	4,024
Percentage	6.1	8.9	44.3	24.4	16.3	

* From Public Safety Department, Automobile Club of Southern California.

By this classification much additional light is shed on the manifold bearing of accident causes. Under the first four items, for instance, it is developed that of the 891 cases in which blame for accidents was placed upon "careless and confused pedestrians," in 394 the pedestrian victim was either under 5 years of age or over 65 years; giving rise to the very fair question whether, in the last analysis, the major responsibility in these cases did not rest upon the motorist rather than upon the pedestrian.

The relative numbers of pedestrians and car occupants killed in these accidents, as given in Table 17, constitute still another phase of the motor vehicle problem treated in the automobile club's report, from which Chart V is taken; and from the figures submitted in this con-

CHART V

MOTOR VEHICLE FATALITIES

THIRTEEN SOUTHERN COUNTIES

COURTESY AUTO CLUB OF SOUTHERN CALIFORNIA

1923 - 1927 INC.



nection, it becomes evident that reckless and careless drivers are a menace not alone to the man on the street, but in even greater degree to the passengers in their own and other cars.

TABLE 17

Pedestrians and Car Occupants Killed in Motor Vehicle Accidents—California, Thirteen Southern Counties

	1923	*1924*	*1925*	*1926*	*1927*	*Total*
Pedestrians	270	277	261	310	362	1,480
Car occupants	432	444	537	545	586	2,544
Totals	702	721	798	855	948	4,024

THE NONLOCAL CAR AS A FACTOR IN ACCIDENTS

Along another line, a study made in Connecticut was productive of information regarding the origin of cars involved in motor vehicle accidents in that state, that is of especial significance to the State of California in view of its geographical extent, the diversity of its local regulations, the millions of its own registered cars, and the great number of out-of-state cars at all times within its borders. The results obtained from the Connecticut analysis are here summarized in Table 18.

TABLE 18*

Origin of Cars Involved in Accidents—State of Connecticut

	Per cent of total			
	1925	*1926*	*1927*	*Average*
Local cars	52	57	54	54.3
Nonlocal cars, state registry	38	36	38	37.3
Nonlocal, out-of-state registry	7	7	8	7.4
Unknown registry	3	--	--	1.0
	100	100	100	100.0

* From "Fourth Study of Motor Vehicle Accidents."

If, as indicated by the ratios practically constant throughout this three years' investigation, 45 per cent of all cars involved in motor vehicle accidents are nonlocal, their drivers unfamiliar with local motoring habits and regulations and enforcement, then certainly it is of vital concern to California that uniformity of local traffic ordinances and uniformity of law enforcement through all the state be speedily effected.

INCREASING SEVERITY IN LAW ENFORCEMENT

More and more the necessity of drastic law enforcement, with unfailing punishment for the wilful violator, and with means by which the criminally reckless, the negligent and the incompetent can be driven from the use of the streets and highways, as so urgently advocated by the Hoover Conference, has assumed importance in the minds of the authorities upon whom rests the burden of public welfare; and the committee directs attention to Table 19, in which some available figures are given as fairly indicating the resulting trend in disciplinary policy and practice.

TABLE 19

Connecticut—Discipline in Automobile Law Violations[1]

	1924	*1925*	*1926*	*1927*
Arrests made	11,904	13,536	17,159	22,421
Charges not prosecuted	2,591	3,371	1,739	2,588
Jail sentences, days	11,870	27,943	24,998	40,052
Fines imposed	$247,248	$255,013	$249,516	$347,885
Licenses suspended	7,757	8,434	8,821	10,750

Maryland—Discipline in Automobile Law Violations[2]

	Fines	*Driving licenses Revoked*	*Suspended*	*Refused*	*Drivers reprimanded**
1926-1927	$213,049	905	2,036	1,747	19,986
1927-1928	235,962	1,149	2,116	2,332	37,649

* License card punched and notation entered on record.

Connecticut—Penalizing Drunken Drivers[1]

	1924	*1925*	*1926*	*1927*
Fines	$90,114	$102,710	$97,357	$153,221
Jail sentences, days	5,047	7,023	13,866	19,570
Cases nolled	79	89	59	95
Licenses suspended	1,022	1,204	1,356	1,615

[1] From "Fourth Study of Motor Vehicle Accidents," Connecticut.
[2] From Reports of E. Austin Baughman, Commissioner of Motor Vehicles, Maryland.

The committee notes, in all the records in its hands, an ever-widening tendency to greater rigor in the punishment of violations of the motor vehicle laws; and, with all others who have engaged in the study of the motor vehicle problem, is convinced that in such severity will be found the principal factor in its solution.

COMPENSATION OF DAMAGE CLAIMS

Much has been heard of financial losses resulting to individuals from unpaid claims for damages arising out of automobile accidents, and the committee has spared no pains in its efforts to ascertain the facts regarding such losses. While the investigation of this phase of the problem was blocked in most directions by paucity of authentic records, the net result of the committee's findings is the discrediting of the alleged enormous totals of such losses.

Elsewhere (page 65) in this report the results of an appeal to the 10,825 members of the State Bar for information regarding unsatisfied judgments and failure to receive compensation in suits in such cases are given in detail. Here it need only be noted that the losses cited in reply, some of which date back three, five and six years, totaled only $39,977; and in no case was the victim or any dependent made thereby a recipient of charity.

In like manner an inquiry made of charitable agencies in a number of cities throughout the country to ascertain facts regarding persons directly or indirectly made recipients of charity in consequence of death or injury incurred in motor vehicle accidents, established only that the records of these agencies fail to show this cause of dependency, or that extremely few known cases of the kind have come under their care. In view of the minute detail with which such agencies have in recent years been accustomed to record their cases, it seems a fair

assumption that automobile accidents do not figure among the major causes of dependency.

The same inquiry was extended to hospitals, state and county officials, and other persons and organizations thought likely to have definite knowledge of such losses and their social and economic consequences, but in all instances with negative results, the most precise information secured being the statement, made in most replies, that no such cases had come within the experience of the respondent.

That financial losses result from death, injury and property damage sustained in automobile accidents is, of course, beyond question. But that such losses remaining uncompensated do not reach the huge totals that have at times, vaguely and without supporting data, been alleged, seems equally beyond doubt in the light of all positive findings.

Among the data on this subject that have come into the hands of the committee during its investigation is a report submitted by the Commonwealth Club of California, which includes studies, with summaries and conclusions, made by authority of its board of governors. While the methods used by the club in its questionnaires, in its handling of figures, in its determination of groupings and in the conclusions of its summaries are the most unusual encountered by the committee in the course of its investigation, nevertheless, for the light thrown on the subject under consideration by the statistics themselves, the committee reproduces here without change the portion of the study relating to fatal accidents, calling attention by means of footnotes to those errors and omissions only which alter percentages, totals and averages given by the club, or which substantially affect the significance of the figures used.

In so introducing the club's statistics into this report, the committee deems it proper to direct attention to these circumstances:

1. That throughout the study the club entirely disregards the question of legal liability; or rather, to put it more accurately, placidly assumes in every case legal liability on the part of the motorist;

2. That the determination of "responsibility," "irresponsibility," and "party causing the accident" in the study is solely a matter of the club's judgment, not the committee's; and

3. That no tables of supporting data have been supplied to the committee.

The club states that this study covers all fatal automobile accidents occurring in San Francisco and Alameda counties during the year 1927; and that of the 263 such accidents discovered it was able to collect answers to its questionnaires in 206* cases, or approximately 78 per cent.

* The "Groups" listed in the study comprise 203, not 206 cases; and one of the odd features of the club's brief is that it makes computations, and draws conclusions from its data, on the basis not only of 206, but also of 263 cases, thus including in its premises the 60 cases regarding which its states it had no information.

The club presents its findings on the 208 cases in the following form:

GROUP I

Party causing accident did carry insurance and some compensation was paid as a result of the accident.

Dependents	*Partial dependents*	*Recovery*	*How obtained*
3	2	$7,500	Lawsuit
0	--	4,000	Compromise
1	--	2,000	Compromise
5	--	2,000	
0	--	1,000	
0	--	700	
0	--	500	Compromise
2	--	500	Compromise
0	--	400	Compromise
0	--	400	Compromise
0	--	400	Compromise
0	--	375	
0	--	300	Compromise
0 (Child)	--	200	Compromise
0	--	200	Compromise
0 (Child)	--	200	Compromise
0 (Child)	--	75	Compromise
0	--	Funeral expenses	Compromise
0	--	Unknown amount	

Number of cases 19
Number of cases reporting amount of compensation received 17
Total amount of compensation received by persons reporting (highest recovery $7,500 and lowest recovery $75) ..... $20,950[1]
Average amount reported received ..... 1,232[2]

[1] Apparently error; correct total is $20,750.
[2] Correct average $1,221. "Funeral expenses" and "Unknown amount" are evidently not compensation in the club's view.

GROUP II

Party causing accident did not carry insurance and some compensation was paid as result of the accident.

Dependents	*Partial dependents*	*Recovery*	*How obtained*
1	--	$1,500	
(Housewife)	--	425 Inst.	Compromise[1]
0 (Child)	--	300 Inst.	Compromise[1]
0 (Aged 88)	--	150	Compromise
0 (Aged 75)	--	Funeral Expenses	Compromise
6	--	$260	Compromise
3	--	Support of family	Compromise
1 ($1,985 Dr. bill)	--	$350	Compromise[2]
		$1,000 Expenses	Compromise

Number of cases 9
Number of cases reporting amount of compensation actually received or promised 7
Total amount received or promised ..... $3,985[3]
Average amount received or promised ..... 569[3]

[1] The club's brief does not explain the abbreviation "Inst."
[2] While a compromise settlement of $350 would appear highly improbable with a $1,985 doctor's fee outstanding, yet it is not stated that the bill was paid, and the amount is not included in the total given.
[3] Here again, "Funeral expenses" and "Support of family" are evidently not compensation in the mind of the club.

GROUP III

Compensation received, but not stated whether it was from party who caused the accident or his insurer.

Number of cases 1
Amount of compensation received $1,700 50

GROUP IV

No compensation, due to the fact that there was no one to lose financially by the death of the decedent.
Number of cases 2

GROUP V

No compensation, due to difficulties peculiar to decedent's family.
Number of cases 6

GROUP VI

Party who caused the accident carried insurance and suit is now pending.
Number of cases 21

GROUP VII

Unknown whether party who caused the accident carried insurance, and suit is now pending.
Number of cases 2

GROUP VIII

Party who caused the accident did not carry insurance and there is a suit pending.
Number of cases 12

GROUP IX

Party causing the accident did carry insurance but there was neither recovery nor a law suit.
Number of cases 9

GROUP X

Party who caused the accident was not insured, and not sufficient witnesses to justify bringing suit.
Number of cases 3

GROUP XI

Party who caused the accident was insured, suit was brought, but judgment was rendered in favor of the defendant.
Number of cases 2

GROUP XII

No compensation because the accident was partially or wholly fault of the deceased, admittedly.
Number of cases 14

GROUP XIII

No compensation because accident arose from carelessness of a wholly irresponsible third party.
Number of cases 1

GROUP XIV

No settlement and no suit was filed, due to dislike of parties for court proceedings.
Number of cases 4

GROUP XV

No recovery, due to difficulty with the attorney engaged.
Number of cases 1

GROUP XVI

No compensation because deceased was struck by a government truck.
Number of cases 3

GROUP XVII

Party causing the accident is responsible but no suit brought.
Number of cases 1

GROUP XVIII

No compensation, but it is not made clear why suit was not brought.
Number of cases 6

GROUP XIX

No compensation and no suit, due to the irresponsibility of the person causing the accident, who was not insured.
Number of cases 28

GROUP XX

No insurance in the party causing the accident, no compensation and no definite reason given for not bringing an action, though it is probable that failure to sue is due to the irresponsibility in the party causing the accident.
Number of cases 26

GROUP XXI

Neither compensation nor a law suit, and the collision was with a street car or a train.
Number of cases 4

GROUP XXII

Suit is now pending, and collision was with either a street car or a train.
Number of cases 4

GROUP XXIII

No compensation and no insurance, and a motorcycle was the cause.
Number of cases 1

GROUP XXIV

No compensation, due to mechanical difficulties with the car driven by deceased or in which deceased was riding.
Number of cases 4

GROUP XXV

Hit-and-run drivers.
Number of cases 20

Passing by, without comment, the club's decidedly unusual handling of figures in its summary of the above study, and prescinding from its equally unusual conclusions therefrom, the committee notes the following points in connection with the "groups" presented:

In the 24* cases where the amount of compensation received is stated, the highest of the settlements was for $7,500 and the lowest was for $75; eight were for $1,000 or more, one was for $700, nine ranged from $500 to $300, and six were for less than $300; the average for the

* Excluding the cases where the compensation received was "Funeral expenses," "Support of family" and "Unknown amount," and the case where it is not stated if payment of the $1,985 doctor's bill was part of the compromise settlement.

24 cases being $1,087. For comparison, it is recalled that in the death and personal injury cases cited by the members of the State Bar, the highest judgment awarded was for $5,000, the lowest for $350, and the average was $2,665.

In the 28 cases where the information is given, the total number of dependents was 22, with 2 partially dependent.

The 203 cases listed may, on the club's statement of them, be summarized as follows:

Settlement effected at time of inquiry (I, II, III)	29
Suits for damages pending (VI, VII, VIII, XXII)	39
Elected not to sue, for special reasons (IV, V, IX, X, XIV, XV, XVII, XVIII, XXI, XXIII)	37
Patently no liability in motorist (XI, XII, XIII, XVI, XXIV)	24
Elected not to sue, in club's opinion, because motorists were "irresponsible" or "probably irresponsible" (XIX, XX)	54
Hit-and-run drivers (XXV)	20
Total	203

As bearing on the question of liability in these fatal accident cases, it is of interest that while in 52 cases (Groups I, III, VI, IX, XI) the motorists are stated to have carried insurance, in nine (Group IX) of them there was neither suit nor settlement, and in two (Group XI) there were suits with verdicts for the motorists, making 11 cases, or one-fifth of all, evidently without liability. Again, there are 22 cases listed (Groups XII, XIII, XVI, XXIV) which on their face bear evidence of no liability, six more (Groups XV, XVII, XXI) which carry a strong presumption of no liability, and 19 others (Groups IV, V, XIV, XVIII, XXIII) in which the election not to sue seems fairly to justify an assumption of no liability.

There thus remain, out of the 203 cases included in the study, the 20 hit-and-run cases of Group XXV, the 28 cases of Group XIX, and the 26 cases of Group XX, a total of 74, in which on the club's statements there was, either surely, or probably, or possibly, liability without recovery. And on the basis of the ratio established in Groups I and II, the relict dependents of the victims in these 74 cases would number 58, with an additional five partially dependent; while, on the assumption of legal liability in every case, damages accruing to all would total $80,438 at the average shown for Groups I, II and III of $1,087, which is more than double the amount actually received in 15, and more than the full amount received in three others, of the 24 cases included in those groups.

In the second part of its study, in which it endeavored to gather information in relation to nonfatal motor vehicle accidents occurring in San Francisco and Alameda counties during 1927, the Commonwealth Club met with a sterility of results that led it to state in its brief that "because of the much smaller percentages of the returned questionnaires the data on the nonfatal accident cases can not have the same conclusiveness that may be found in the study on fatal injuries."

With approximately 6000 questionnaires and letters sent out to injured persons, the club was able to secure only 672 returns. It nevertheless made a tabulation of results, and found that "the nonfatal accident cases reported showed higher percentage of insurance carried and compensation paid than in the fatal cases." The general tenor of

the club's statistics is thus in accord with the findings of similar investigations, the marked trend of which wherever made has been towards discounting the supposed magnitude of uncompensated losses attending motor vehicle accidents.

Through the cooperation of the county clerks in the entire state, who, as ex officio clerks of the superior court, at the request of the committee undertook the burden of a laborious search in the court records of their respective counties, the committee is enabled to incorporate in this report a detailed statement of all judgments, for death and personal injury resulting from automobile accidents, entered in the state during the two years prior to November 20, 1928,* and standing unsatisfied of record at that date.

The research of the county clerks revealed such judgments to the number of 621 and to a total amount of $2,110,089.40 for the two years. The figures for the individual counties are shown here in Table 20:

TABLE 20

Unsatisfied Judgments in Automobile Cases—California—Two Years

County	*Two years period*	
	Number	*Amount*
Alameda	105	$318,466 94
Alpine	None	
Amador	None	
Butte	None	
Calaveras	None	
Colusa	None	
Contra Costa	11	34,103 71
Del Norte	None	
El Dorado	None	
Fresno	None	
Glenn	3	2,575 00
Humboldt	1	3,000 00
Imperial	None	
Inyo	None	
Kern	8	21,244 14
Kings	None	
Lake	None	
Lassen	None	
Los Angeles	250	784,598 15
Madera	None	
Marin	(1)	1,745 00
Mariposa	None	
Mendocino	None	
Merced	38	25,896 98
Modoc	None	
Mono	None	
Monterey	(2)	6,975 10
Napa	4	16,729 00
Nevada	None	
Orange	10	59,917 90
Placer	1	1,200 00
Plumas	None	
Riverside	11	94,156 85
Sacramento	19	112,333 47
San Benito	None	
San Bernardino	5	11,197 10
San Diego	20	93,836 94
San Francisco	33	147,900 00
Forward	522	$1,735,876 28

* For some of the counties the totals run to December 13, 1928, and for some others to January 15, 1929.

TABLE 20—Continued

Unsatisfied Judgments in Automobile Cases—California—Two Years

County	*Two years period* *Number*	*Amount*
Forwarded	522	$1,735,876 28
San Joaquin	14	138,559 70
San Luis Obispo	2	549 40
San Mateo	15	20,503 99
Santa Barbara	8	20,959 84
Santa Clara	20	98,415 05
Santa Cruz	7	18,785 30
Shasta	None	----------
Sierra	None	----------
Siskiyou	None	----------
Solano	6	6,220 68
Sonoma	9	12,538 26
Stanislaus	8	19,230 75
Sutter	None	----------
Tehama	None	----------
Trinity	None	----------
Tulare	9	37,429 25
Tuolumne	None	----------
Ventura	None	----------
Yolo	None	1,020 90
Yuba	1	----------
Totals, two years	621	$2,110,089 40

NOTE.—The figures of Table 20, while serving the desired purpose, are not precisely accurate as used. In the case of some counties some of the judgments have been entered so recently that their payment prior to date of this report was not possible, while other judgments are known to have been paid, but their satisfaction not having been recorded they are included in the number and amount given as outstanding of record. Regarding some other counties, through a misunderstanding the figures supplied are for all judgments entered in automobile injury cases, both satisfied and unsatisfied; and in other cases judgments under appeal are included as unsatisfied. For some counties the figures given include judgments in property damage cases; and in a number of instances particular judgments were for both property damage and personal injury, without segregation of the respective amounts. Court costs awarded are also included. The figures given in the table are for these various reasons higher than the actual number and amount of unsatisfied judgments for the two years period; but, with this explanation, they are used as received.

Assuming one-half of the totals in Table 20 to represent the cases for one year, the amount will be $1,055,044.70 and 310.5 the number of judgments.

The average struck on this basis is $3,397.89; and in view of the fact that a comparatively small number of judgments for quite high amounts are included, the average for the great majority is very much lower. This is readily seen by taking the detailed judgments listed for some of the counties:

Contra Costa County		*Tulare County*	
$200 00		$306 50	
750 00		500 00	
750 00		535 00	
880 00		650 00	
1,236 21		921 75	
1,500 00		1,521 00	
1,500 00		1,732 00	
1,523 50		6,250 00	
1,764 00		25,013 00	
4,000 00			
20,000 00			
$34,103 71		$37,429 25	
Average	$3,100 34	Average	$4,158 81
Average, excluding last	1,410 37	Average, excluding last	1,802 03

San Diego County Department 3		*Santa Cruz County*	
$579 85		$250 00	
731 53		500 00	
1,250 00		500 00	
2,038 75		590 15	
2,107 90		2,250 00	
2,167 00		2,500 00	
4,555 65		12,195 15	
14,037 00			
25,052 30			
$52,519 98		$18,785 30	
Average	$5,835 55	Average	$2,683 61
Average, excluding last two	1,678 75	Average, excluding last	1,098 36

Other similar instances are:

	Average
Orange County—10 judgments, $59,917.90	$5,991 79
Average, excluding three totaling $47,879.40	1,719 79
Riverside County—11 judgments, $94,156.85	8,558 80
Average, excluding three totaling $76,130	2,253 85
San Diego County—6 judgments, $33,877.26	5,646 21
(Department 1.) Average, excluding two totaling $23,840	2,509 31
San Joaquin County—14 judgments, $138,559.70	9,897 10
Average, excluding five against one defendant totaling $66,552.65, and two others totaling $47,304	3,529 01
Santa Clara County—20 judgments, $98,415.05	4,920 75
Average, excluding two totaling $60,000	2,134 17
Stanislaus County—8 judgments, $19,230.75	2,403 84
Average, excluding one for $10,095	1,305 11

The relation of unsatisfied judgments to all judgments is indicated in statistics given for some counties, as:

San Francisco City and County—Judgments entered			113
	Satisfied	53	
	Not satisfied	33	
	Appealed	17	
	Vacated	1	
	New trial	9	
Marin County—Number of actions filed			48
	Pending	23	
	Dismissed	13	
	Judgments entered	12	
	Satisfied	11	
	Not satisfied	1	

On the basis of the amount above, $1,055,044.70, the average of unpaid judgments per registered car in the state for 1928 would be about 42 cents; and using the estimate of 28,850 as the number of death and injury cases for the same year, the average of unpaid judgments per death or injury would be $36.57.

Affording further information on the subject, and confirming the view of the committee that the magnitude of the evil of uncompensated losses resulting from automobile accidents has been grossly overstated, the Automobile Club of Southern California has submitted to the committee an analysis of some 10,000 accident claims establishing the percentage of claims actually paid and the reasons why the remainder go uncompensated, and giving tables showing the average amounts paid on such claims.

The study offered by the club is here presented as table 21:

TABLE 21*

Analysis of Accident Claims—California. Thirteen Southern Counties. 1926-1927.

	Number of claims	*Per cent of total*
Total number of claims examined	10,039	100
A—Claimant not entitled to recover—		
Because claimant solely negligent	1,104	11
Because both parties negligent	1,205	12
Because claimant's right extremely doubtful	1,406	14
Not entitled to recovery	3,715	37
B—Valid claims paid—		
By insurance companies	2,309	23
By individuals	1,707	17
Total satisfied	4,016	40
C—Valid claims not paid—		
Because debtor not located	502	5
Because claimant failed to cooperate	150	1½
Because debtor declared inability to pay	251	2½
Because arbitrary refusal by insurance companies	401	4
Because arbitrary refusal by individuals	1,004	10
Total unsatisfied	2,308	23

* From Public Safety Department, Automobile Club of Southern California.

As this theme of uncompensated claims for damages has been much played upon in connection with the ill-considered urging of so-called compulsory insurance from some quarters, the committee quotes some comments made by the automobile club in regard to the details brought out in the above table:

"We present the above analysis as a fairly complete explanation of why damages resulting from motor vehicle accidents are not compensated. Clearly, compulsory liability insurance would have no application to those instances in which the claimant is not legally entitled to recover, comprising 37 per cent of the total. Neither would compulsory insurance add any security with reference to those valid claims collected, comprising 40 per cent of the total. With reference to those valid claims not collected, representing 23 per cent of the total, reference to the reasons why such claims are not paid discloses that compulsory liability insurance would not necessarily result in payment being made.

Compulsory insurance would not insure payment in those instances where it was impossible to locate the second party or where the claimant failed to cooperate, nor in those instances where there was an arbitrary refusal by an insurance company. Compulsory insurance might have some bearing in those instances listed above, where the debtor declared inability to pay and where there was an apparent arbitrary refusal by an individual to pay. These last two items taken together represent a total of 1255 claims, representing 12.5 per cent of all claims.

It should be noted that of the 10,039 claim files examined, the average amount involved was $49.76.

That the average amount of claims for property damage is less than $50 in substantiated by the experience of our Inter-Insurance Exchange. The claims paid by the exchange on property damage insurance in 1927 were in the average amount of $27.71. Under full coverage collision policies, insuring members' cars against damage by reason of collision, the claims paid were in the average amount of $23.53."

With reference to the average payments made under public liability insurance policies for death and personal injury, the club notes that some 75,000 of its members carry such insurance, and that it has secured from the companies writing the policies a statement as to the number and amount of the claims and payments made thereunder during the years 1926 and 1927.

This information the club filed with the committee in the form of tables, which are here presented as Table 22. In reproducing this data, attention is directed to the facts that the average of payments for death and personal injury under these public liability insurance policies was $265.60 for both 1926 and 1927, and that the number of cases in which payment exceeded $1,000 represents but 6 per cent of all paid claims.

TABLE 22

Average Payments* Under Public Liability Insurance Policies—California, Thirteen Southern Counties, 1926-1927.

	1926	1927
Number of policies in force December 31	68,946	75,219
Total claims filed	3,517	4,007
—no indemnity	1,475	1,673
—paid, under $1,000	1,919	2,222
—paid, over $1,000	123	112
Claim frequency, paid	2.96	3.10
Average amount, claims filed	$154 21	$156 00
Average amount, claims paid	$265 60	$265 60
Average amount, claims paid over $1,000	$2,125 23	$2,167 78
Average amount, claims paid under $1,000	$146 40	$169 65
Percentage, claims paid	58.06	58.25
Percentage, claims no indemnity	41.94	41.75
Claims paid over $1,000	6 %	4.8%
Number paid $1,000-2,000	68	60
2,000-3,000	34	32
3,000-4,000	14	9
4,000-5,000	2	1
5,000-6,000	1	5
6,000-7,000	1	2
7,000-8,000	2	2
8,000-9,000	1	1
Totals	123	112

* From Public Safety Department, Automobile Club of Southern California.

As being closely related to the matter of uncompensated claims, the brief filed with the committee jointly by the California State Automobile Association and the Automobile Club of Southern California was supplemented with an appendix under the caption, "Compulsory Liability Insurance Would Apply to a Very Small Percentage of Traffic Accidents," in which they reiterate their opposition to the principle of compulsory security of liability, and express their skepticism regarding the alleged advantages of the plan in force in Massachusetts, the only state which has adopted legislation for compulsory automobile insurance.

While the Massachusetts act and other proposals for security of liability are discussed more fully in Part II of this report, the committee presents here, as pertinent to the subject at present under consideration, some excerpts from the comments appended to the brief, with which the committee is in full accord.

Using as a basis the fatal automobile accidents occurring in the thirteen southern counties of California during the years 1923 to 1927 (see above, Tables 11 to 17, and Charts IV and V), the clubs have this to say:

"The total fatalities were 4024. Of these 1598, amounting to 39.71 per cent of the total, were received in a type of accident as to which compulsory or liability insurance would have practically no application. They were accidents in which the individuals killed were solely or mainly at fault.

Fatalities in Motor Vehicle Accidents—Thirteen Southern Counties, 1923-1927, both inclusive.

Classification by type	*Number*	*Percentage of total*
Motor vehicle and electric or steam railway	518	12.88
Motor vehicle overturned—non-collision	790	19.63
Falls from motor vehicle	147	3.65
Motor vehicles and stationary objects	143	3.55
	1,598	39.71

Compulsory or liability insurance would have no application to accidents of the above type except in a few instances where an injured passenger or the heirs of a deceased passenger might have a right of action against a driver who survived the accident. The remainder of the 4,024 fatalities are classified as to type of accident as follows:

	Number	*Percentage of total*
Motor vehicles vs. motor and other vehicles	946	23.51
Motor vehicles and pedestrians	1,480	36.78
	2,426	60.29

With reference to the fatalities occuring in collisions between motor vehicles and motor or other vehicles and between motor vehicles and pedestrians, numbering 2426, or 60.29 per cent of the total, there are many circumstances under which compulsory insurance would have no application. We list the following: (1) accidents caused solely by the negligence of the pedestrian or motorist suffering damage, (2) accidents in which the pedestrian or motorist suffering damage is guilty of contributory negligence, (3) accidents following which the operator or vehicles causing the damage can not be located (our claim records shows that these amount to approximately 5 per cent of the total), (4) accidents in which the motor vehicle is being operated by a thief or other person not authorized by the owner.

As noted previously in the report, the Massachusetts Compulsory Insurance Act has no application to numerous other situations including (1) accidents which do not occur upon public highways, (2) accidents caused by nonresidents temporarily within the state, (3) accidents caused by motor vehicles owned by the state, counties and cities.

As giving a comprehensive idea of the responsibility for motor vehicle accidents, we set forth certain data compiled by the Committee on Insurance of the National Conference on Street and Highway Safety. The committee tabulation was based upon information received from insurance companies and covered automobile accidents occurring in 244 cities of 44 states. The report analyzed automobile accidents according to responsibility, as follows:

	Per cent
Careless or reckless automobile driver	32.7
Careless or reckless pedestrian	29.3
Both parties jointly	18.7
Other highway users, including wagons, trains, street cars, bicycles, motorcycles, etc.	16.4
Defective automobile	2.7
Physically defective driver	0.2
	100.0

Thus, upon examining the table first set forth above with reference to types of accidents, we find that 39.71 per cent of all fatalities occurred in types of accidents as to which compulsory insurance would have no application. Of the remaining 60.29 per cent we may reasonably conclude by reference to the second table set forth

above that approximately one-third of said fatalities represent instances in which the careless or reckless automobile driver is solely responsible and the injured party has a clear right of recovery. In all other instances, as disclosed by the table, the sole negligence or contributory negligence of the injured party was a contributing factor in the accident or the cause was one which would not impose liability on the motorist.

Assuming that 20 to 25 per cent of all accidents represent instances in which the injured party has a clear legal action for damages against the motorist, we must, of course, recognize that a substantial portion of such motorists voluntarily carry insurance or are otherwise financially responsible at the present time.

While it is extremely difficult to positively estimate what percentage of accidents give rise to clearly valid claims against uninsured and financially irresponsible motorists, it appears obvious from the above analysis that such percentage is small. This is an important factor in determining what advantages would be obtained by the adoption of compulsory liability insurance of the type enacted in Massachusetts."

The committee, in unanimity with all California organizations from which it has heard except two, and with all national organizations without exception, including the American Automobile Association, the American Motorists Association, the American Roadbuilders Association, the Committee of Nine, the National Safety Council, the Chamber of Commerce of the United States, and the National Conference on Street and Highway Safety (the Hoover Conference), rejects the proposal of compulsory automobile insurance, so-called, as no safety or accident-prevention measure, and as but a partial and highly ineffective means of protection against pecuniary loss; and believes that the Massachusetts plan, in particular, not only has not proved itself after two years' trial, but has become, as was foretold by its opponents it would become, the football of politicians and the tool of frauds and crooks.

In the light of developments in Massachusetts, the committee believes it would be unwise to impose upon the State of California legislation at once so drastic and so futile, and so lacking even the elemental principles of accident prevention.

PART II

THE MASSACHUSETTS COMPULSORY AUTOMOBILE INSURANCE LAW

AND

FINANCIAL SECURITY MEASURES ADOPTED BY OR PROPOSED IN OTHER STATES

THE MASSACHUSETTS COMPULSORY AUTOMOBILE INSURANCE LAW AND THE FINANCIAL SECURITY MEASURES ADOPTED BY OR PROPOSED IN OTHER STATES.

Pursuant to the instructions of the Legislature, the committee has made, and presents here, a study of the Massachusetts compulsory automobile insurance law and of the automobile liability security laws adopted in the states of Connecticut, Maine, Minnesota, New Hampshire, Rhode Island and Vermont, as well as a study of various proposals for compulsory security of liability and for compulsory compensation in motor vehicle accidents, which have been put forth from various quarters but have not been adopted by any state.

From a perusal of the following pages it will be seen that the legislation recommended by this committee, while avoiding the pitfalls and the disadvantages of the Massachusetts plan of compulsory insurance of all motor vehicles, incorporates the provisions of the laws of other states which make for safety and accident prevention, and goes beyond them in the direction of establishing liability and securing compensation in motor vehicle accidents.

THE MASSACHUSETTS PLAN

Compulsory Insurance Against Liability for Personal Injury

Property loss occasioned by financially irresponsible motorists, while it probably reaches a large yearly total, is seldom as much as a hundred dollars and generally less than fifty dollars in any one case, and is not at all likely to bring suffering or want in its wake. Furthermore, the expense of securing the financial responsibility of all motorists against such losses, and the costs of resulting litigation, with its entail of court congestion and confusion, would be so great as, beyond question, to outweigh all advantages that might be hoped for.

For these and other similar reasons the compulsory motor vehicle insurance law of Massachusetts was restricted in its comprehension to personal injuries and death.

PROVISIONS OF THE LAW

The law was passed in 1925, was amended in 1926, and came into force on January 1, 1927. It applies to all motor vehicles registered in the state, except those owned by the state or its subdivisions, common carriers, public utility corporations, or publicly regulated street railway companies, and vehicles covered by other statutes.

With the above exceptions, no motor vehicle may be registered unless the applicant presents with his application one or another of the following certificates:

(1) From a licensed insurance company, that it has issued to the applicant a motor vehicle liability policy covering the vehicle to be registered for the term of the registration, in the required form, and

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* Prepared from the committee's data with the assistance of John H. Clendenin, M. Sc., former Associate in Economics, University of California at Los Angeles; Teaching Fellow in Economics, University of California, Berkeley; Research Statistician, Los Angeles Stock Exchange.

in the amounts of $5,000 for injury to or death of one person, and $10,000 for injury to or death of more than one person in the same accident.

(2) From a licensed guarantee or surety company, that it has issued to the applicant a motor vehicle liability bond under the same requirements and terms as the above-mentioned insurance policy.

(3) From the State Department of Public Works, that the applicant has deposited with the department in cash or securities not less than $5,000 as guaranty against liability during the term of registration for injury or death resulting from the operation of the applicant's motor vehicle.

As noted, the liability under the policy, bond or deposit is in respect to personal injury and death only, and does not regard property damage. The security is to satisfy all judgments rendered against the applicant, or against any persons responsible for the operation of the applicant's motor vehicle with his express or implied consent, in actions to recover damages for bodily injury, including death at any time resulting therefrom, sustained during the term of the registration by any person, other than employees of the applicant or of such other persons responsible as aforesaid who are entitled to payments or benefits under the workmen's compensation act, and arising out of the ownership, operation, maintenance, control or use upon the ways of the commonwealth of such motor vehicle, to the amount or limit of at least $5,000 on account of injury to or death of any one person, or at least $10,000 on account of any one accident resulting in injury to or death of more than one person.

No policy or bond certified under the act can be validly canceled without written notice at least fifteen days prior to the effective date of cancelation being filed with the registrar of motor vehicles, who, upon receipt of such notice, or upon the company issuing the policy or bond ceasing to be authorized to do business in the state, shall notify the registrant to file new security, and in default thereof shall forthwith revoke the registration license.

Classification and rates for motor vehicle liability policies and bonds are determined by the State Commissioner of Insurance, subject to review by the Supreme Court, and no such policy or bond may be issued or delivered in the state until the form has been approved by him. The statutory conditions of such policies and bonds are prescribed; and classifications of risks and schedules of premiums proposed to be used and charged must be filed with, and approved by, the commissioner before any company may write such policy or bond. Appeal from a decision or order of the commissioner lies to the Supreme Judicial Court for the county of Suffolk, which has power to modify, reverse, amend or affirm such order or action, in regard to questions either of fact or of law involved therein.

A board of appeal on the cancelation and refusal of such policies and bonds is constituted, consisting of the Commissioner of Insurance or his representative, the Registrar of Motor Vehicles or his representative, and a member of the Attorney General's department.

The provisions of the law apply only to motor vehicles when licensed in the state and when operated on the public highways. The law does not apply to nonresidents of the state, offering no remedy to persons

injured through the operation of automobiles not licensed by the state. The law likewise has no application in the case of accidents outside the state borders caused by cars of Massachusetts registry.

WORKING OF THE LAW

It may be noted that of 778,895 motor vehicles registered during the first nine months after the law became effective, none at all was covered by the liability bond allowed, and a negligible number—fewer than fifteen—by deposit of cash or securities with the division of highways. All others were registered under the first alternative, the filing of a certificate showing the issuance of an automobile liability insurance policy.

The Massachusetts law has now been in operation approximately two years, and may fairly be considered to offer evidence as to the merits of the plan. The proponents of the law had anticipated the following as the principal beneficial results to be derived from its enactment:

First—A reduction in the number of accidents on the highways, due to more careful driving.

Second—Removal of the reckless and incompetent driver from the road, as a result of inability to obtain insurance.

Third—Assured financial compensation for innocent parties injured by financially irresponsible motorists.

Fourth—Elimination of worn-out and broken-down cars, usually owned and driven by financially irresponsible drivers.

Fifth—A uniform insurance which could be administered at a lower cost, and could therefore offer proportionately lower rates.

Whether or not these anticipations have been realized in the actual operation of the law is, to say the least, an open question. There are, however, certain well-established results which may be noted:

(1) In 1927, the year after the law went into effect, fatalities resulting from automobile accidents numbered 698, as compared with 681 in 1926. Injuries were 32,922, as compared with 24,904 in 1926. Collisions reported numbered 33,938, as compared with 26,769 in 1926.

While more complete reports may have been procured by the police authorities in 1927, certainly the record makes no showing of a reduction of accidents. The number of personal injury claims filed with the insurance companies in 1927 was 48,519, as compared with 14,678 claims filed in 1926 against the insurers of 30 per cent of the motor vehicles in the state.

(2) Under practical working of the statute, the insuring companies can not effectively refuse insurance to applicants. During the first eighteen months of the law's operation, the companies attempted refusal of insurance to hundreds of applicants whose driving records showed them to be poor risks; but the board of appeals compelled them to issue policies of insurance in all except 28 cases. It is hard to believe that there were but 28 reckless and incompetent drivers among the million and a half who applied for registration of their cars during that year and a half; and, despite the board's explanation that its decisions were based on a policy of nonreference to past history, and that bad driving

under the new law would result in revocation of insurance and license, it does not seem that the compulsory insurance law is operating to remove dangerous drivers from the road.

(3) A slight decrease in the number of motor vehicles registered in the state after the new law went into effect may give some comfort to those who hoped that the added cost to motorists would keep worn-out, and therefore dangerous, cars out of operation. The matter, however, is still in question, and the registration figures, when available for the entire year 1928, may rob the advocates of the measure of even this small consolation.

(4) It has proved impossible to keep insurance in force on all cars registered in the state. The office of the insurance commissioner estimated that there are 2,000 cars operating illegally, which are not likely to be detected unless they chance to be stopped and investigated for some other offense. The insurance companies likewise reported that many car owners, after securing registration upon partial payments of premiums, failed to complete their payments, thus voiding their insurance; and the majority of these delinquents have not been apprehended by the police.

(5) Despite the uniformity of the insurance, and despite the lessened coverage of policies issued under the provisions of the act as compared with the coverage under the old voluntary policy, the cost of insurance to the individual car owner has greatly increased, almost to prohibitive levels, under the new compulsory system. The principal reasons assigned for this outcome are:

First—Rates for voluntary insurance are based on the records of the voluntary insurers, and these are generally the more careful drivers, who have fewer accidents. With the right of selecting their risks effectively denied to the companies, and insurance required to be issued to all applicants, the insuring of all cars results in a higher loss cost per car, and of course a higher premium cost.

Second—Automobile accident litigation has been greatly increased in the state, due to the unreasonable claims advanced, and to the large and increasing number of false claims. While the former are to some extent held in check by fair-minded juries, the latter have proved especially troublesome and expensive to the insurance companies and the state. In the words of Governor Fuller: "The situation that prevails is a complicated one, because of the fact that the compulsory insurance law has lent itself to all kinds of bribery, chicanery and misrepresentation. Large numbers of people have made fraudulent claims under the law and have been aided and abetted in this contemptible practice by doctors and lawyers alike."

An indication of the extent of the evil is found in the fact that while only 32,922 injury cases were recorded by the authorities in 1927, 48,519 claims were made against the insurance companies; and state officials, alarmed by the gravity of the situation thus created, have felt it necessary to threaten punitive measures, the governor recently stating to the press that "The fraudulent claims that have been permitted under the working of the compulsory insurance law call for a change in the law so that these abuses can be eliminated. Otherwise the people of Massachusetts will demand a state fund."

While it is not apparent how the governor reasons such a change would better the situation, nor conceivable that the people of Massachusetts would consider experimenting with a state fund after their experience with the compulsory insurance law, there can be no question about the extent or the gravity of the fraudulent claim problem that has arisen, nor of its telling effect on the rates that must be charged.

The rates first fixed under the new law in Massachusetts, and continued by the insurance commissioner for 1928, to await a longer experience of their operation under the act, were quite similar to those previously in effect on the basis of voluntary insurance. Two years of disastrous losses to the insurance companies, however, forced a material increase in the rates prepared by the commissioner for 1929, in some cases as much as 100 per cent, as in the Boston area. The date set by law for promulgating the new rates fell in the midst of a political campaign, and the governor of the state refused to sanction the proposed increase. The insurance commissioner declared that without an increase in the rates it would not be possible to continue administration of the act, and resigned his position.

Following this, the new acting commissioner refused to promulgate new rates. Several insurance companies withdrew from the state; others appealed to the Supreme Court, which handed down a decision that new rates must be established.

This was accordingly done by the acting commissioner; and for purposes of comparison the 1927 and 1929 rates for the Boston area (comprising about one-fourth of the state's population) and the Massachusetts farming area are given here, with corresponding area rates under California voluntary policies, with wider coverage, for 1929:

	Small cars	*Medium cars*	*Large cars*
Boston rate, 1927	$29	$37	$45
Boston rate, 1929	47	47	62
San Francisco rate, 1929	30	35	43
Los Angeles rate, 1929	20	24	29
Massachusetts farming area rate, 1927	16	20	25
Massachusetts farming area rate, 1929	14	21	28
California farming area rate, 1929	12	17	23

(6) The coverage of the insurance issued under the Massachusetts compulsory law is very limited in extent. It does not, for instance, afford protection to injured persons in any of the following cases:

(a) Where the injured party is himself at fault. Recovery can be had only when no blame, either through negligence or contributory negligence, attaches to the claimant. One large casualty company reports from a study of its experience that the injured party is either wholly or partially responsible in 70 per cent of the accidents listed in its records. Statistics compiled by the insurance committee of the Hoover Conference put the proportion at 67 per cent.

(b) When no party appears to be at fault, or when there are no witnesses.

(c) When the insured motorist can not be proven to be solely at fault.

(d) When the motorist causing the injury can not be identified.

(e) When a thief or other person unauthorized by the owner of the vehicle is the offending driver.

(f) When the accident is caused by a motor vehicle owned by the state, or a city, or a county or other political subdivision.

(g) When the car at fault is of out-of-state registry.

(h) When the accident is caused outside the state by a car of Massachusetts registry.

(i) When the accident occurs off the public ways of the state.

(j) When the accident is caused by any agency other than a motor vehicle, or by a motor vehicle of any of the classes excepted by the act.

(k) When the owner of the offending car has evaded the compulsory insurance law, or the car is operated after cancelation of the insurance covering it.

(l) When the insured motorist is himself the injured party.

(m) When the doctrine of imputed negligence may bar recovery, as in the case of joy-riding parties.

(7) The Massachusetts law places a heavy burden on the careful driver who would voluntarily carry insurance, for it not only increases the rate he must pay for the insurance provided under the compulsory policies, but also necessitates his taking additional insurance to secure coverage equal to that of his voluntary policy. It is likewise considered unfair to certain classes, like the farmers, who have few accidents and are usually financially responsible, and who otherwise would not carry insurance.

(8) Politics have entered into the administration and operation of the Massachusetts law. Promulgation of rates as required by the law has been denied on the ground of political expediency, and the rates themselves have been determined on the same basis. The resignation of an insurance commissioner esteemed both in the state and throughout the country for his capability was forced, and chaotic conditions obtained. The state lost the services of several important casualty companies, due to the attempt to force them to write insurance at ruinously low rates, before an appeal to the Supreme Court of the state resulted in an order for the long-denied promulgation of new rates. And as the latest step in the progress from one evil to another, the new rates have been kept from being still higher only by the action of the state in directing an arbitrary and sweeping reduction of agents' commissions.

(9) As indicating the expense of the system to the taxpayers of the state, it is noted that at the close of the year 1928 the calendars of the courts are so hopelessly overcrowded with automobile claim cases that the establishment of additional courts throughout the state for the handling of these cases is under consideration by the authorities. During the five months from October, 1927, to February, 1928, there were 7297 such cases entered in the Superior Court, as against 3207 entered during the same period of the year before, an increase of 128 per cent, compared with an increase of less than 2 per cent for all other classes of cases.

(10) It is believed, on the basis of estimates from different sources, including the Hoover Conference, that the operators of motor vehicles

are liable in not more than 35 per cent (the estimates range down to 30 per cent and lower) of personal injury cases. Equally careful estimates fix, as a minimum, 20 per cent of car owners as the proportion voluntarily carrying insurance against public liability; one-half are considered to be financially responsible, and three-fourths as being sufficiently responsible to be able to satisfy small claims. Making allowance for the customary liberality of juries, 15 per cent is probably an extreme estimate of the personal injury cases that now go uncompensated; and the average money value of such claims is small, as has been set forth at other places in this report. (Cf., for instance, page 40, citing the experience of the Automobile Club of Southern California: Members insured, approximately 75,000; number of claims paid in two years, 4376; claims above $1,000 paid, 235, average $2,146.50; average all claims paid, $265.60.)

From considerations such as these, it would appear that the Massachusetts law in its practical working is grossly inequitable to many of the injured, to law-abiding motorists and to the general taxpayer; and that any advantages derived from its operation are seriously outweighed by the disadvantages following from it.

Opinion of the committee. With accident prevention and safety consideration admittedly thrown into the discard as impelling motives for compulsory automobile insurance, the prospect of monetary compensation to the injured remains as its only substantial justification; and the results of the Massachusetts experiment appear to demonstrate not only that it is less effective in this direction than voluntary insurance, but also that the cost is out of all proportion to the benefits derived. It is the opinion of the committee, in the light of present experience, that it will be unwise for the State of California, with the complicated problem that confronts it, to embark upon any such dubious legislation as that in which Massachusetts, with a far lesser problem, has become entangled. In this conviction, as has been noted elsewhere, the committee is confirmed by the unequivocal opinions of local and nationwide bodies.

The committee is constrained to note that, in direct contrast with the unfortunate results of the Massachusetts imbroglio, the financial security laws that have been adopted in other states appear to be working satisfactorily, and to be productive of good results along the lines of safe driving and accident prevention.

Summaries of these laws are given in the following pages; and from their perusal it will be observed that the essential provisions of all of them are comprehended in the specific recommendations of the committee as presented in Part III of this report.

THE CONNECTICUT LAW

Requiring Security Against Liability in Certain Cases

The Connecticut legislation was originally enacted in 1925, to become effective January 1, 1926. It was repealed and, in effect, reenacted with amendments in May, 1927, coming into force on July 1, 1927, with the exception of the first section relating to minors, which took effect on January 1, 1928.

The provisions of the law are substantially as follows:

(1) It forbids

(a) Any minor between 16 and 18 years of age to operate any motor vehicle upon the highways of the state, and

(b) Any person to permit or cause any such minor to operate a motor vehicle unless the owner has filed with the commissioner of motor vehicles proof of financial responsibility, as stipulated below.

(2) It empowers the commissioner of motor vehicles to require proof of financial responsibility for payment of claims for personal injury within limits of not less than $5,000 $10,000 and property damage within a limit of not less than $1,000.

(a) From any person who is convicted of, or evades or avoids prosecution for, violation of the provisions of the motor vehicle law relating to special licenses for public service operators, failure to obey an officer of the law, reckless driving, driving while intoxicated, operating without owner's permission, racing, evading responsibility, leaving vehicle in dangerous condition, failure to stop when approaching railway car receiving or discharging passengers, defective brakes, false testimony, wrongful use of registrations or tags; and

(b) From the operator of a motor vehicle involved in an accident causing injury to or death of any person, or damage to property of not less than $50; or from the person in whose name the vehicle is registered; or from both.

When such proof is required of any person, the commissioner may require the same proof for each motor vehicle owned or registered by him.

The proof required to be furnished may be a certificate of public liability insurance, or a surety bond, or a deposit of cash or collateral. Such proof, in whatever form filed, must be satisfactory to the commissioner, and, if a policy of insurance, can not be canceled except after ten days' notice to him.

The commissioner may at any time require additional proof to be filed. He may cancel or return the bond, certificate of insurance, or deposit after three years if in the meantime the person furnishing it shall have maintained a clear record, and if no judgment or right of action arising out of motor vehicle operation is outstanding against him.

If proof of responsibility is not furnished when required, the commissioner may suspend or revoke the license of the person in default, or revoke the registration of any vehicle involved, or refuse registration of any vehicle owned by such person; or, in the case of a nonresident, may withdraw his privilege of operating, or having operated, within the state any motor vehicle owned by him.

Upon demand the commissioner must furnish to insurance companies the operating record of any person subject to the act, and to injured persons information as to proof of responsibility filed with him.

That the Connecticut law, in actual operation, is effectually serving the purposes of its sponsors is evidenced by the results achieved during 1927, when security as required by the law was filed by 7898 operators who were convicted of negligence or of violation of the motor vehicle law, while the licenses of 2080 drivers were canceled and 944 were suspended under this statute.

THE MAINE LAW

Financial Security from Reckless and Drunken Motorists

The Maine law was adopted in April, 1927, and became effective January 1, 1928.

The law provides that the secretary of state shall require from any person who is convicted of operating a motor vehicle recklessly or while under the influence of intoxicating liquor, or from the registered owner of such vehicle, or from both of such persons, such proof of financial responsibility to satisfy any claim for personal injury up to $5,000 or property damage up to $1,000, as shall satisfy the secretary, which may be in the form of an insurance policy, bond, cash, securities, or other collateral.

For noncompliance with such requirement the secretary may suspend the registration of the motor vehicle or refuse registration to any vehicle owned by the person in default, or, if such person is a nonresident, withdraw his privilege to operate a motor vehicle, or to have operated any motor vehicle owned by him, in the state.

Penalties are provided for failure to return number plates and registration certificates; and the secretary is empowered to make rules and regulations to carry out the provisions of the act.

Upon request, the secretary must furnish insurance companies the operating record of any person subject to the act.

The secretary may cancel or return the bond, policy or security three years after its deposit, if in the meantime the person who deposited it shall not have violated any provision of the motor vehicle laws, provided that no right of action or judgment arising out of the operation of a motor vehicle is then outstanding against him.

THE MINNESOTA LAW

Indemnity Against Negligent and Unlawful Motorists

The Minnesota law was approved and became effective on April 23, 1927.

The law is one regulating the use of the highways, and among other things provides that, upon conviction of any person of driving recklessly or while under the influence of liquor or narcotics, the court may make an order forbidding such person to drive a motor vehicle on any highway in the state for such period not exceeding two years as the court shall fix, unless such person shall execute and file with the registrar of motor vehicles an indemnity bond in the amount of $2,500, conditioned that he will pay all damages any person may sustain in consequence of any negligence or unlawful act committed by him in operating a motor vehicle upon any such highway during the period so fixed.

THE NEW HAMPSHIRE LAW

Aid to Recovery from Liable Motorists

The New Hampshire law became effective on June 1, 1927. It is modeled on what is popularly known as the "Stone plan."

The law provides that, upon petition in an action for damages for injury to person or property resulting from a motor vehicle accident, the court shall institute a preliminary inquiry; and if it is found that the accident was probably due to negligence of the defendant, without evidence of contributory negligence on the part of the plaintiff, the

court shall order the defendant to furnish such security as the court may think sufficient against final judgment, not exceeding, however, $5,000 for bodily injury or death, nor $1,000 for property damage.

As such security there may be filed a certificate either from an authorized insurance company that it has issued a liability policy, or from an authorized surety company that it has issued a liability bond, in the prescribed form, and in the amounts of at least $5000/$10,000 and $1,000 as to any one accident, covering the motor vehicle involved.

If the defendant files, or has already filed, such a certificate the petition for a preliminary hearing shall be dismissed.

In the event of failure to comply with such order, the commissioner of motor vehicles must suspend the defendant's license and the registration of any motor vehicle owned by him; and, if the motor vehicle involved was operated by or with the consent of an owner not the defendant, must likewise suspend said owner's license and the registration of all motor vehicles owned by him. If there is no New Hampshire license or registration involved that may be suspended, the court must enter an order prohibiting the defendant, or defendant and owner, from operating or having operated in the state any vehicle owned by him. Such revocation, suspension and prohibition shall continue in effect until the required security is filed.

The law provides that the operation of a motor vehicle in the state, either by the owner, or with his express or implied consent, shall constitute the commissioner of motor vehicles the attorney of a non-resident owner for the service of process.

The state insurance commissioner estimates that, during the first year the New Hampshire law was in force, the proportion of registered car owners carrying insurance increased from 30 per cent to approximately 70 per cent, rather impressive testimony to the effectiveness and satisfactory results of the law's operation.

THE RHODE ISLAND LAW

Security Against Future Liability

The Rhode Island law was adopted in April, 1927, and came into force on June 21, 1927.

The law provides that whenever a motor vehicle is involved in an accident on the public highways causing injury to person or damage to property amounting to $100 or more, the state board of public roads may make an investigation, and if it appears to such board that there has been a violation of law relative to reckless driving, speeding, emitting excessive smoke, driving while intoxicated, driving with the muffler cut out or driving an unregistered vehicle, the owner shall be required to furnish, at his election, either a certificate of insurance against liability for injury to persons or damage to property, with limits of not less than $5000 $10,000 and $1,000, or a bond in the penal sum of not less than $10,000 nor more than $20,000, to indemnify any person who may thereafter be injured or damaged by any motor vehicle belonging to such owner, or evidence of financial responsibility up to $20,000 to answer for injuries to persons or damage to property thereafter caused by any motor vehicle belonging to such owner, but not more than one bond, etc., may be required of any one person regardless of the number of motor vehicles he may own.

If the operator or owner of such motor vehicle be a nonresident, the board may suspend, for not more than a year, his right to operate any motor vehicle, or to have operated any motor vehicle owned by him, in the state.

Any decision of the board is subject to review by the courts upon appeal by any party aggrieved.

The operator of a motor vehicle with the consent, express or implied, of the owner, lessee or bailee thereof, is deemed to be the agent of such owner, lessee and bailee.

Penalties are provided for false certificates of insurance; and it is provided that no terms of a policy or bond shall operate to avoid it as against a judgment creditor of the principal.

Persons and firms otherwise required to file bonds, and motor vehicles exempted from registration fees, e.g., hospital ambulances and vehicles owned by municipalities, are exempted from application of the act.

THE VERMONT LAW

Financial Responsibility After Conviction for Certain Offenses

The Vermont law was passed in March, 1927, and became effective on June 1, 1927.

The law provides that the commissioner of motor vehicles shall require from any person convicted of a violation of certain sections of the motor vehicle act (*i.e.*, provisions relative to careless or negligent operation or speeding, operating under influence of intoxicating liquor or drugs, failure to stop after accident and operating after suspension, revocation or refusal of license) and from the registrant of any motor vehicle involved in an accident resulting in injury to (including death of) any person or damage to property amounting to $100 or more, when it appears that the operator of such vehicle was at fault, such proof of financial responsibility to satisfy any claim for damages, up to the limits of $5000 $10,000 and $1,000, as shall be satisfactory to the commissioner, which may be evidence of insurance or the bond of a surety company.

The bond or policy of insurance must be noncancelable, except after ten days' notice to the commissioner; and he may at any time require additional evidence of responsibility.

After proof of financial responsibility has been so required of a person, he shall not be entitled to renew his license or again register any motor vehicle unless such proof, or a renewal thereof, is kept on file and in force, except that the commissioner may relieve a registrant from further continuing the bond or policy after three years, if, during such period, he is not convicted of any violation of the motor vehicle law and has not suffered any suspension or revocation of license, provided that no suit or judgment is then outstanding against him arising out of the operation of any motor vehicle.

For failure to comply with such requirement, the commissioner shall suspend the license of such person and the registration of any and all motor vehicles registered in his name and refuse thereafter to register any such vehicle owned by him or subject to his control, or, if such person is a nonresident of the state, suspend the right of such person to operate in the state any motor vehicle owned or controlled by him.

Upon request, the commissioner must furnish insurance companies the operating record of any person subject to the act.

Penalties are provided for failure to return number plates and certificates of registration.

THE PENNSYLVANIA PLAN

Suspension of Motorists' Licenses Pending Payment of Judgments

The so-called Pennsylvania plan was adopted by the legislatures of both Pennsylvania and New York. In Pennsylvania, as the Buckman bill, it was vetoed by the governor because he deemed it in conflict with a provision of the state constitution; in New York, where it was known as the Fearon bill, it was likewise vetoed by the governor, because of the failure of the bill to set limitation upon the amount of the judgment required to be paid.

The plan provides that whenever a final judgment for injury to or death of a person or for damage to property, caused by the operation of a motor vehicle, remains unsatisfied for sixty days, the judgment may be certified to the commissioner of motor vehicles, who shall thereupon suspend all driving licenses and automobile registrations of the judgment debtor; and no such suspension shall be lifted, nor shall new licenses or registrations be issued, until the judgment shall have been discharged of record. The plan provides severe penalties for violation of such suspension.

The Pennsylvania plan, while avoiding the entanglements of compulsory insurance proposals, has several particular merits: It would make judgment debtors, generally, try to pay instead of evade payment; it would provide a strong inducement to voluntarily insuring against public liability; it would beyond question impel financially irresponsible drivers to be more careful; and it would undoubtedly remove many financially irresponsible and careless or unfit drivers from the roads.

Until the appearance, late in December, 1928, of the "Safety-Responsibility Bill" sponsored by the American Automobile Association (see page 58 of this report), the Pennsylvania plan was held in more widespread favor probably than any other proposal for securing the financial responsibility of motorists.

THE MARX PLAN

Compensation in All Automobile Accidents

On the theory that automobile injuries are a state problem, and are to be reckoned with and compensated by the state no matter how received, Judge Robert S. Marx of Cincinnati suggests a plan by which automobile owners would be compelled to carry a new kind of automobile accident insurance guaranteeing compensation for any type of injury to themselves or others. Fixed schedules of recompense would be provided, scaled in accordance with the nature of the injury, and in proportion to the earnings of the persons injured. Special rates would be provided for housewives, children, and the unemployed, medical attention being included.

The plan is intended to relieve the automobile owner from all liability for damages, except that the compensation to the injured person would be increased, by the administrative authorities, by 15 up to 50 per cent for negligence or violation of law, which extra compensation would be payable by the insurer and assessed against the owner.

The insurance would be provided, according to the plan, through a monopolistic state fund, or by a state fund and private companies in competition, or by private companies only.

Marx professes to believe that his plan would reduce litigation, would reduce the expense of administering automobile insurance, and would eliminate unscrupulous lawyers and false claims; would, in brief, be a veritable panacea, for under it, he claims, no family would be left unrecompensed and in want, due to an automobile accident.

Some of the most obvious objections to the Marx plan are the following:

(1) As the plan would lack any legal basis, such as the employer-and-servant relationship on which the workmen's compensation law is founded, it seems beyond question that insurance companies would refuse to participate, and execution of the plan would necessitate the creation of a public fund administered by a state bureau.

(2) Study of the plan with a view to its practical operation makes clear that its enactment into law would necessarily entail (a) the simultaneous abolishing of the law of negligence, all civil actions and civil causes of action for personal injuries, and all jurisdiction of state courts in such causes, (b) the withdrawal of all phases of the premises from private controversy, and (c) the arbitrary award and compulsory acceptance of the proposed compensation regardless of questions of fault, to the exclusion of all other remedies, and in lieu of all rights of action against any person.

(3) As even the inventor concedes that the plan could not be made to apply to property damage cases, the law of negligence, rights of action and jurisdiction of courts would remain as regards such cases; and the situation would undoubtedly arise of courts and juries making larger awards for damage to automobiles than the schedule of payments under the plan would allow for personal injuries and death.

(4) The cost would be prohibitive. Marx estimates that the cost of operating his plan would be between $10 and $20 per car per annum, but competent underwriters estimate the cost at as high as four times that amount at the outset; and in accordance with universal experience the calls upon such a fund would undoubtedly increase from year to year.

(5) The compensation would, of course, be very limited in amount, and would unquestionably be so inadequate as to satisfy no one.

(6) The state would inevitably be drawn in administratively, for investigation, to determine earnings and injuries, to defend litigation, and to ascertain damages in innumerable other ways.

(7) The plan could not cover accidents off the highways or outside the state, nor tourists from other states.

(8) The plan is, of course, not a safety or accident prevention measure.

(9) As there are few motor vehicle accidents in which either negligence or some violation of law is not involved, with all consideration of legal liability abolished the assessment of the 15 to 50 per cent increase of compensation against the motorist in addition to his annual payment into the fund could be anticipated as quite the ordinary thing. And,

in this connection, attention need hardly be directed to the administrative and legal expenses incident to proving the offense and enforcing payment of the assessment.

(10) The theory upon which any such scheme is built is fundamentally wrong in principle. In the words of one* of the foremost students of the subject in the country, "Any measure of so-called public protection that lumps the careful and law-abiding motorists in with the careless and criminal, that forces on them insurance designed for the careless and criminal, and that puts on them the burden of the losses of the careless and criminal, is basically unsound."

(11) There is considerable doubt as to the constitutionality of any such plan, both under state and federal constitutions.

(12) Politics would unquestionably enter into any administration of such a plan; it would invite fraud and impositions; and the evils that have attended the Massachusetts experiment with compulsory insurance would be multiplied and magnified in connection with this plan.

The Marx plan has not, in as far as the committee has been advised, been considered by the legislature of any state; and it is the opinion of the committee that it is wholly impracticable.

AMERICAN AUTOMOBILE ASSOCIATION

Safety-Responsibility Bill

Since the preparation of this report, the American Automobile Association, as a result of an exhaustive study of compulsory liability insurance and safety measures by its specially appointed National Committee of Seventeen has, for the third time within three years, gone on record as opposing any form of compulsory automobile insurance, and has prepared a "Safety-Responsibility Bill" aimed to promote safe driving and to remove the irresponsible driver from the highways.

The association states that it does not submit this bill with a recommendation that its proposals shall be adopted in every state, because it recognizes that there are states where no problem of the kind under consideration exists, but that the legislation proposed will, where needed, serve the public interest in a practical manner, and place a direct responsibility where it should be placed, without forcing upon a large part of the population a financial burden which would not of itself achieve the desired results.

Through the labors of the Committee of Seventeen, in collaboration with its executive committee, the association has devised this safety-responsibility bill "as a constructive measure designed to protect all the users of the highways against the reckless, incompetent, and irresponsible driver. Directed primarily at the menace to person and property, from a reckless and criminal minority, the safety-responsibility law seeks to control this minority.

"To accomplish this purpose, it sets up simple legal machinery whereby the state, as the unit of local government, is empowered to deprive of the use of the highways those operators who have demonstrated that they are an actual or potential menace to their fellow motorists and to the public in general. Restoration of the right of such people to use the road is made contingent in this proposed law on

* Edson S. Lott, in an address before the Pittsburgh Chamber of Commerce.

the establishment of specific safeguards against possible future damages to persons or property. This is, of course, in addition to whatever disabilities, restrictions and penalties are provided for in the motor vehicle codes of the various states for such offenders. In other words, the safety-responsibility law, while embodying several fundamental principles, is in the nature of supplemental legislation. * * *

"The committee which formulated the bill has had constantly in mind the fact that the streets and the highways are public assets; that the automobile is a vital factor in the country's business, social and economic life, and that the large mass of law-abiding, careful drivers should be permitted the use of the streets without subjecting them to unreasonable burdens, financial or otherwise. For this reason, the safety-responsibility law is frankly directed at the small minority of reckless and irresponsible motor vehicle operators to whom are chargeable the mounting toll of loss of life and injuries to persons and property. The committee concluded that it was manifestly unnecessary and unfair to compel the overwhelming majority of motorists to carry insurance to protect the community against the damage caused by the small minority. The same unfairness would result from the proposal for the state to enter the insurance business and compel all motorists to contribute to a state fund. The all-important thing, however, is that legislation should be sound in principle. The safety-responsibility law is sound in principle, since it approaches the subject from the standpoint of national safety and since it confines its penalties, burdens and disabilities to those proven guilty of offenses against the public welfare."

The proposed law embodies the following principles:

First, it provides for the enactment of the Uniform Motor Vehicle Operators' and Chauffeurs' License Act by all states that do not now have such a law on their statute books. The control of the privilege of driving rests with each state, and it is obvious that control is more complete in those states requiring drivers to secure an operators' license.

Second, it provides for mandatory suspension of the driving permits of all persons found guilty of serious violation of motor vehicle laws. In addition to whatever penalties the state laws provide for these offenders, the safety-responsibility law definitely bars them from the road until they have established satisfactory proof of their financial responsibility against future injuries to persons or property.

Third, it provides for the suspension of the driving rights of all persons against whom a final judgment establishing the driver's negligence has been legally rendered and who have failed to meet the judgment. This suspension is to remain in effect until the judgment has been satisfied and until a future guarantee of financial responsibility has been established. While this provision does not absolutely guarantee the payment of a final judgment, the prospect of permanent expulsion from the road is such a compelling alternative that it will inevitably tend to secure the essential payment of such in time to reduce unpaid judgments to the vanishing point.

Fourth, it provides for the insertion in the driver's license law of every state of a proviso which will forbid the issuance of a permit to any person whose right to drive is at that time suspended in any other

state because of failure to respond in damages or because of other serious violations of motor vehicle laws. This, in effect, provides for interexchange of suspension rulings, as between the states, and would render the disability nationally reciprocal.

PART III

RECOMMENDATIONS

III

RECOMMENDATIONS FOR CHANGES ENACTMENT AND ENFORCEMENT OF MOTOR VEHICLE LAWS

Many proposals of various kinds have of course been received and considered by the committee, and it has studied and, in making its decisions, has been influenced by the numerous communications, reports and briefs which have been submitted to it, and by public discussions and private conferences. From these sources some of the material of this report has been drawn, and to them reference will be made from time to time in the discussion of the specific recommendations which follow.

The committee is convinced that it is possible to prevent a large part of the present loss in property damage, personal injury and death, by determining safety measures and motor vehicle legislation in accordance with certain definite policies or guiding principles. As examples of such principles, with which all recommendations in this report conform, the committee suggests the following:

1. Compulsion, and adequate uniform methods, of accident reporting; collection and analysis of accident and traffic statistics; study of accident causes and trends, and of traffic problems and regulations. In short, acquisition of the knowledge that must be the basis of intelligent regulation.

2. Continuing revision of the motor vehicle law, based on the factual findings indicated above, and in accordance with a progressive program for legislation in furtherance of public safety, and for effecting uniformity of law within the state and with other states.

3. Vigorous, unremitting and uniform enforcement of the motor vehicle law throughout the state, by the local police within their jurisdictions, and elsewhere by statewide motor vehicle police operating under exclusive state control; rigid investigation of all serious accidents; and, as far as may be effected, unfailing prosecution and uniform punishment of violations of the law.

4. Broadening of liability of persons permitting, or otherwise responsible for, negligent operation of motor vehicles; revocation of licenses of persons failing to satisfy final judgments establishing their negligence in the operation of motor vehicles; and denial of relicensing to such judgment debtors prior to satisfaction of the judgments and establishment of security against future liability.

1. COMPULSION, AND ADEQUATE UNIFORM METHODS, OF ACCIDENT REPORTING; COLLECTION AND ANALYSIS OF ACCIDENT AND TRAFFIC STATISTICS; STUDY OF ACCIDENT CAUSES AND TRENDS, AND OF TRAFFIC PROBLEMS AND REGULATIONS. IN SHORT, ACQUISITION OF THE KNOWLEDGE THAT MUST BE THE BASIS OF INTELLIGENT REGULATION.

A traffic bureau should be created to gather and analyze accident and related statistics, and study accident causes and traffic problems, with a view to presenting recommendations for legislation and other means for prevention of accidents and the increase of public safety.

The committee has been seriously hampered in its investigation of the California situation by inability to obtain data on traffic accidents and their causes and results. In many cases reports and other material on the subject simply do not exist, not having been required to be kept by any official or other person or body. In other instances, city and county records have been kept, but so lack uniformity of method and

purpose that their use for statewide compilation and comparison is impossible. Again, in other cases, existing statistics are so involved in the records of courts and institutions and governmental departments as to be practically inaccessible.

District attorneys and sheriffs and other officials have advised the committee that, if the Legislature would appropriate funds for clerk hire for the purpose, they would gladly furnish desired information, but that, without such help, the necessary labor would be too much for their overworked staffs.

Hospitals are concerned with the character and extent of injuries, and their records are kept accordingly. That the injuries were received, for example, in a traffic accident is, from their viewpoint, of little interest; and the attempt to get this information from their files was futile, involving so much time and painstaking care, that the hospitals of the federal government and those conducted by the Sisters were, almost without exception, the only ones responding to the committee's inquiries.

So, also, in the case of the charity organizations from which have come periodic outbursts about the numbers of cases thrown upon them for support through financial irresponsibility of motor car drivers; their records, too, seem kept along other lines, and from them and related sources the committee was able to discover only an utterly insignificant number of such cases.

For several months, through the courtesy of President Webb and the Board of Governors, the journal of the State Bar carried to its members an earnest request to report to this committee automobile cases where recovery was defeated through the insolvency or financial irresponsibility of guilty drivers causing death or injury to persons. From a membership of 10,825 twenty-six replies were received, citing 54 cases, of which, on inquiry, only 34 proved to be personal injury cases. These 34 cases were distributed as follows:

Insurance was carried in	8
Settlement was made, or part or full recovery was had, in	5
Compensation was awarded in	1
Accounting for a total of	14
Of the remaining twenty cases, liability was not established in	5
Leaving, as personal injury cases with liability established and no recovery had	15
Total amount of judgments entered in these fifteen cases	$39,977
The maximum judgment awarded was	5,000
The minimum judgment awarded was	350
The average is	2,665

The results shown are interesting; but the entire return from the inquiry is of course too small to be the basis of any conclusions.

The instances cited are typical of the committee's experiences in its attempts to accumulate accurate and reliable statistics. In response to questionnaires sent out to twenty-six groups, comprising officials, institutions and others, only 85 complete returns, and 104 incomplete returns, were received; in 1073 instances records had not been kept or were unavailable, or the labor involved in extracting from them the desired information was too great to be undertaken.

It therefore seems to the committee highly important and desirable that suitable records be required to be kept by appropriate agencies, and

that analyses and studies of accident and traffic statistics be regularly made and published from a competent source, so that the public, the Legislature, and administrative and law enforcement officials may be constantly informed of the latest developments in the traffic situation. Such analyses and studies should center on the fundamental and contributing causes of accidents, and the efficacy of corrective and preventive measures, and should of course be correlated with similar studies made for other states and for the country at large.

The committee has been influenced in the recommendation it makes on this subject by many considerations. It has been much impressed by the enlightening results of similar studies made for a number of years in the State of Connecticut, by comparative tables contained in the reports of the Maryland Commissioner of Motor Vehicles, and by the highly useful publications of such organizations as the National Safety Council, some of the larger life insurance companies and the American Roadbuilders Association. The measure which this committee proposes has been urgently recommended by the National Conference on Street and Highway Safety (the Hoover Conference), the Chamber of Commerce of the United States, the American Automobile Association and the American Motorists Associations; and local sentiment is no less favorable.*

Heretofore but two classes of data in relation to traffic accidents have been required to be filed, in the form of reports from operators of motor vehicles involved in injury or death, and reports, from justices of the peace, police judges and courts, of convictions and bail forfeitures in violations of the Motor Vehicle Law. These reports have been intended primarily to guide the Division of Motor Vehicles in its supervision of motor vehicle operators, with especial reference to suspension and revocation of licenses; but the law requiring their filing has unfortunately been more disregarded than observed, and the chief of the division, with an already heavily burdened staff, has only very recently been able to organize with any degree of adequacy this portion of the work imposed upon his office.

The committee believes that the present requirements of law as to the keeping of records relating to accident and traffic problems are grossly insufficient. It further believes that the analytical and statistical studies called for in relation to those problems should receive and be the subject of special attention.

With this conviction, the committee recommends the creation by the Legislature of a traffic and safety bureau attached to the Division of Motor Vehicles, the scope of the duties of which shall comprehend the work outlined in the foregoing paragraphs, and which shall be empowered to receive and require from motor vehicle operators, police departments, the state traffic police, county and state officials, and other appropriate sources, reports and information necessary or useful for accomplishment of the purposes indicated.

An act embodying this recommendation will be found as Appendix A at page 79 of this report.

* During the preparation of this report, the State Motor Vehicle Conference, the Automobile Club of Southern California, the California State Automobile Association, the Commonwealth Club of California and the newly organized Committee on Public Safety with its thirty-one constituent bodies have gone on record endorsing the principle of the committee's recommendation.

2. CONTINUING REVISION OF THE MOTOR VEHICLE LAW, BASED ON THE FACTUAL FINDINGS INDICATED ABOVE, AND IN ACCORDANCE WITH A PROGRESSIVE PROGRAM FOR LEGISLATION IN FURTHERANCE OF PUBLIC SAFETY, AND FOR EFFECTING UNIFORMITY OF LAW WITHIN THE STATE AND WITH OTHER STATES.

A. The motor vehicle law of this state should be brought into entire conformity with the Uniform Vehicle Code of the National Conference on Street and Highway Safety as rapidly as possible.

"This code," in the words of California's most distinguished citizen, President-elect Hoover, "was formulated with the widest cooperation of those having understanding and experience in these matters, with a view to advancing uniformity in our traffic laws and regulations. The urgency of such action requires no emphasis from me. It has been demanded from every state in the Union. Without uniformity in essential laws and regulations, reduction in loss of life, personal injury and property damage upon our streets and highways is virtually impossible."

The principles upon which the code is based were formulated as the result of studies, including comparison of the existing codes of all the states, conducted by eight committees of the Hoover Conference throughout the year 1924. At the close of that year the principles thus developed received the endorsement of the first conference, and during 1925 and 1926 were drafted and, after widespread distribution for criticism, redrafted in legal form. In March, 1926, the code after detailed consideration was amended to its present form and adopted by the second conference; in July of the same year it was approved by the National Commissioners on Uniform State Laws, and in August received the endorsement of the American Bar Association.*

In 1924 the existing laws of California, Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New York, Rhode Island and Vermont were the substantial basis of the projected code. While it was yet in tentative form in 1926, Virginia amended its law to bring it into conformity. Following its completion in final form, Pennsylvania in 1927 repealed its existing motor vehicle laws and adopted the code practically in its entirety; and since then Arizona, Arkansas, Idaho, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, North Carolina, North Dakota, Oregon, Rhode Island, South Carolina, Washington and Wisconsin have, like California, enacted amendments bringing their laws, to varying extents, into greater conformity.

The Uniform Code is not now greatly different from the present California Vehicle Act. The changes adopted in 1927 were in the interest of conformity, and those recommended in this report bring the two still closer together.

The committee hopes, and urges, that California and its sister states may soon adopt the Uniform Code in its entirety.

* The committee notes with pleasure that another son of California, J. Allen Davis, Esq., counsel of the Automobile Club of Southern California, was the legislative draftsman of the Hoover Committee that formulated the Uniform Code.

B. The Model Municipal Traffic Ordinance of the National Conference on Street and Highway Safety should be adopted by the municipalities of California.

In 1927 Mr. Hoover, at the request of many organizations, members of the National Conference, appointed a committee for the purpose of preparing a model municipal traffic ordinance.

After an exhaustive study of the subject, including analysis of the traffic ordinances proposed by numerous cities, the committee in May, 1928, sent out for criticism its tentative draft of a municipal code. In the following August, after revision into final form, the Model Municipal Traffic Ordinance, with suggested drafts of three supplementary ordinances, was offered by the Hoover Conference to the cities of America, with the prefatory remarks that "it is recommended for the consideration of all communities contemplating revision of their traffic ordinances and desiring to see nationwide uniformity in traffic regulations to the greatest degree compatible with local requirements. The committee realizes that the best of ordinances will be ineffective unless properly and impartially enforced, and urges careful consideration to such enforcement."

The Model Municipal Traffic Ordinance was designed by the Hoover Conference to supplement in municipal legislation the Uniform Vehicle Code of the states; and it has been received with equal favor and widely adopted.

A most prolific source of automobile accidents is the diversity and conflict of local traffic regulations. California preeminently is a tourists' Mecca; and the widespread adoption of the Model Traffic Ordinance elsewhere in the nation establishes the advisability of its enactment by the cities and towns of this state.

In conjunction, therefore, with the recommendation for the Uniform Vehicle Code in the state, the committee very earnestly recommends to the municipalities of California for early adoption the Model Municipal Traffic Ordinance of the National Conference on Street and Highway Safety.

C. Application for drivers' licenses should be required to disclose convictions of the applicants for serious violations of the motor vehicle law, and final judgments entered against them establishing their negligence in the operation of a motor vehicle.

The committee recommends that, in addition to the information now required by the Vehicle Act to be specified in every application for an operator's or chauffeur's license, every such application shall be required to contain also a statement of all violations of the motor vehicle law of which the applicant has been convicted, giving the time and place of conviction, the nature of the violation, and the penalty imposed; and likewise a statement of all final judgments establishing the applicant's negligence entered in any civil action for damages arising out of the operation of a motor vehicle.

An act embodying this recommendation will be found as Appendix B at page 81 of this report.

D. The license of an operator or chauffeur should bear record of its suspensions and revocations, and endorsement of convictions for violations of the motor vehicle law.

As an incentive to careful driving to those who most need it, the committee believes that the license of the driver of a motor vehicle should bear the record of its having been suspended or revoked, and the endorsement of any convictions of its holder for violations of the motor vehicle law. The realization by a driver that an officer stopping him upon the highway for an observed offense against the law will at once upon seeing his license be apprised of his discreditable record, will act as a deterrent from reckless and incautious driving as few other considerations will.

The committee therefore recommends that every driving license issued in future by the Division of Motor Vehicles should bear upon its reverse side appropriate lines whereon the justice of the peace, police judge or court before whom final conviction shall be had, or by whom suspension or revocation shall be imposed, shall endorse the date and particulars of such conviction, suspension or revocation, and whereon the Chief of the Division of Motor Vehicles shall likewise record any suspension or revocation imposed by him.

This recommendation of the committee is intended to include the provision that destroying, altering, erasing or concealing such endorsement shall be a misdemeanor.

An act embodying this recommendation will be found as Appendix C at page 82 of this report.

E. Forfeiture of bail and plea of guilty should be equivalent to conviction under the motor vehicle law.

Reports have come to the committee of cases in other states in which it has been contended that pleas of guilty and forfeitures of bail were not convictions within the purview of the law. Inasmuch as some of the essential enforcement provisions of the Motor Vehicle Law, especially with regard to suspensions and revocations of licenses, are predicated upon convictions, and it is possible, even probable, that those provisions may be evaded under a technical construction of the term "conviction" in the Vehicle Act, the committee deems it advisable and recommends that there should be entered in the act a declaration that for the purposes thereof a plea of guilty or a forfeiture of bail in any court shall be equivalent to a conviction on the charge preferred.

An act embodying this recommendation will be found as Appendix C at page 82 of this report.

F. Applications for registration of a motor vehicle should be required to state public liability insurance carried by the owner.

The committee recommends that in addition to the information now required by the Vehicle Act to be contained in applications for registration of motor vehicles, such application shall be required to contain also a statement as to whether or not the owner of the motor vehicle carries public liability motor vehicle insurance, and in what amount and with what carrier.

An act embodying this recommendation will be found as Appendix D at page 87 of this report.

3. VIGOROUS, UNREMITTING AND UNIFORM ENFORCEMENT OF THE MOTOR VEHICLE LAW THROUGHOUT THE STATE, BY THE LOCAL POLICE WITHIN THEIR JURISDICTIONS, AND ELSEWHERE BY STATEWIDE MOTOR VEHICLE POLICE OPERATING UNDER EXCLUSIVE STATE CONTROL; RIGID INVESTIGATION OF ALL SERIOUS ACCIDENTS; AND, AS FAR AS MAY BE EFFECTED, UNFAILING PROSECUTION AND UNIFORM PUNISHMENT OF VIOLATIONS OF THE LAW.

A. The committee recommends the creation of a statewide motor vehicle police, under exclusive state control, to procure uniform and effective enforcement of the Motor Vehicle Law.

From every side complaints have been received of erratic enforcement, and in some places of total failure of enforcement of the traffic laws on the highways of the state. Believing that inadequate enforcement is a major cause of disrespect for the law, and ultimately the cause of many serious accidents, the committee wishes to propose means for better and more uniform enforcement of the motor vehicle law throughout the state.

At the present time the so-called state traffic officers are nominated by the supervisors of the several counties for appointment by the chief of the state motor vehicle division for patrol of the highways. These patrolmen are restricted to their respective counties, are under county regulation, and are subject to be deputized by their county authorities for duties not related to highway patrol or enforcement of the motor vehicle law. The state motor vehicle division has experienced great difficulty in trying to get cooperation in the execution of its policies from these patrolmen, who regard themselves as county officers; and the public has again just recently witnessed the engaging spectacle of a pair of them defying one of their state inspectors who desired a report of their official doings.

Law enforcement is universally urged as a cure for traffic ills; and centralization of the control of the state motor vehicle police for uniform and effective law enforcement has been recommended by practically every brief and report filed with the committee, and notably by the Automobile Club of Southern California, the California State Automobile Association, the Motor Vehicle Conference, the Committee on Public Safety, the Casualty Legislative Committee and the Commonwealth Club of California.

The last named, in a survey conducted by its traffic hazards section, reported that the most important feature of its legislative program, looking toward more adequate enforcement of the motor vehicle act, was the proposal for a state department of law enforcement, believing "it would be greatly helpful to provide for a body of men of fine personnel, of high morale, thoroughly trained, to introduce and carry out a uniform set of rules applying from Siskiyou to San Diego, and to make sure of their uniform application by firm enforcement."

The committee advocates creation of a distinctive state motor vehicle police with statewide authority under definitely centralized control through a state bureau. It recommends that this force be organized for but one purpose, the enforcing of the police provisions of the motor vehicle law in the interest of public safety.

The committee believes that such exercise of the police power of the state is in no way within the scope of the ordinary or proper purposes of the division of motor vehicles. Particularly in this state, which ranks second only to the state of New York in the number of registered motor vehicles, the duties of the division have rapidly become so many and so varied as to preclude adding to them the maintenance of statewide law enforcement through control of a state police.

It is a recognized principle of sound business that fundamentally different functions should not be indiscriminately combined under one administrative office or department. The committee recognizes the licensing of motor vehicles and their operators, and supervision of the licensees through reports of accidents and court convictions and kindred requirements for guidance in the issuance, suspension and revocation of their licenses, as functions which are varied and of wide extent, yet withal coherent; but to compel through the operations of a force of police the observance of the motor vehicle law by some millions of drivers is a matter wholly different and alien. It is therefore the mind of the committee that the proposed state motor vehicle police will function most efficiently if organized as an enforcement unit independent of the division of motor vehicles.

As the committee is informed that a bill embodying its views has been prepared by the Committee on Public Safety for submission to the Legislature, no act covering the subject is appended to this report.

B. A policy of rigid investigation of motor vehicle accidents, with unfailing prosecution and punishment of law violations thereby disclosed, should be adopted by police authorities throughout the state.

Personal observations, no less than study of reports and statistics, have convinced the members of the Committee that a great many automobile accidents can readily be prevented. It is within the experience of most men in this day that incompetence and disregard of the rights of others are large factors in the production of these accidents; both transform a useful instrument of commerce and recreation into a juggernaut of death and destruction, and both should be dealth with promptly and effectively.

No mistaken sympathy should hinder that those demonstrating their incompetence in the operation of motor vehicles shall, for the common good, be deprived of the licenses under which they operate and be relegated to the learners' class; and the driver, whose disregard of others makes him a deadly menace, striking fear into the hearts of his fellow men, should have it summarily brought home to him that the payment of insurance premiums or damages is not the whole price he must pay for his wanton recklessness.

It is the belief of the committee that investigation of accidents is the surest means to locate such drivers and to establish their guilt. The accident itself can not easily be hidden: and normally at the very suggestion of an inquiry by police authorities the drivers involved will in self-defense produce witnesses from whom the attendant facts of the accident can be learned.

The policy of rigid police investigation of all accidents with prosecution and punishment of all law violations thereby disclosed, has been

in force in the city of San Diego for some months with most satisfactory results. It is probable that the San Diego police do not have as much time left from their work in the investigation and prevention of accidents to devote to parking ordinances, for example, as do the police of some other cities; but they have to their credit in the very marked reduction of deaths and injuries from automobile accidents a record unequaled elsewhere in the state.

Persuaded that all expenditure of time and effort entailed in enforcement of this plan will be amply justified both by the direct advantages to be gained, and by the indirect benefits that will accrue from fixing in the public mind the idea of investigation and punishment as inexorable consequences of avoidable accidents, the committee earnestly urges adoption of the policy by all California cities, and by the new state motor vehicle police force from the time of its organization.

C. The committee recommends for consideration by the Legislature the proposal to enact legislation for setting up traffic fines bureaus in incorporated places to receive pleas of guilty, and fines thereon, to minor violations of traffic laws.

The overcrowded calendars of the courts, and the expense of court procedure and maintenance, put many obstacles in the way of the enforcement of traffic ordinances. On this subject there is presented in one of the briefs filed with the committee by the automobile clubs in the state the following suggestion:

> "The volume of traffic cases coming before local courts has caused such serious congestion in many courts as to prevent the proper exercise of judicial determination in individual cases. As one method of relieving such congestion, certain cities have set up traffic fines bureaus authorized to accept payment of fines in predetermined amounts for minor offenses. Legal question has arisen in connection with the maintenance of such bureaus, and we suggest the advisability of appropriate legislation clearly determining the authority of such bureaus."

The system seems quite feasible, and is advanced from various quarters as a means of freeing the courts from the burdensome detail of routine pleadings. If, however, such bureaus are to be given proper legal status, the committee believes that the limits of their powers and their functions should be clearly defined, and therefore recommends that the Legislature give consideration to the subject in its various implications.

4. BROADENING OF LIABILITY OF PERSONS PERMITTING, OR OTHERWISE RESPONSIBLE FOR, NEGLIGENT OPERATION OF MOTOR VEHICLES; REVOCATION OF LICENSES OF PERSONS FAILING TO SATISFY FINAL JUDGMENTS ESTABLISHING THEIR NEGLIGENCE IN THE OPERATION OF MOTOR VEHICLES; AND DENIAL OF RELICENSING TO SUCH JUDGMENT DEBTORS UNTIL THEIR JUDGMENT SHALL HAVE BEEN SATISFIED AND SECURITY AGAINST FUTURE LIABILITY SHALL HAVE BEEN ESTABLISHED.

A. The state, and its every county, city and other political subdivision employing any operator or chauffeur, whether officer, agent or employee, should be declared jointly and severally liable with such operator or chauffeur for any damages caused by the latter while driving a motor vehicle in the course of his employment.

This recommendation is taken from the Uniform Vehicle Code of the Hoover Conference, and has the support of local organizations.

Under present California law, the state, counties, municipalities and other subdivisions are not liable for negligence of their officers and employees in operating motor vehicles in the course of their employment, except a city engaged in an enterprise other than governmental. Recourse can be had against the driver, but this alone is commonly inadequate, and no action will lie against the governmental agency employing him.

Believing this to be a further step in placing responsibility where it belongs, and in setting up incentives for prevention of accidents, the committee recommends that where individuals sustain death or are damaged in person or property through the negligent operation of a motor vehicle by an officer, agent or employee of the state or of any county, municipality or political subdivision in the state, right of action shall accrue against such public agency or body, if the negligence occurred while the officer, agent or employee was within the scope of his duty, agency or employment; and that any public body required to pay a judgment in such action shall have recourse against the driver whose negligence caused the accident.

An act embodying this recommendation will be found as Appendix E at page 88 of this report.

B. The owner of a motor vehicle should be declared liable for damages caused by negligence in the operation of said vehicle by any person driving it with the owner's permission, express or implied.

Under present law in California, the owner of a motor vehicle incurs liability for its negligent operation only as follows: When operated by the owner; when operated by the owner's agent acting within the scope of his agency; when operated by a person to whom the owner entrusts it knowing that person to be an incompetent or reckless driver; and when operated by a minor whose application for a driving license has been signed by the owner.

From this narrow limitation of the owner's liability it follows that too frequently no effectual recourse is had by persons injured through negligent operation of a motor vehicle driven by a member of the owner's family, or by another person, with the express or implied permission of the owner.

In such cases of operation by a member of the owner's family [illegible] against the owner is granted by court decision or by statute in nineteen states and in some of these, as New York, Michigan and Iowa, statutory provision is made for recovery against the owner in the case of other persons driving with the owner's express or implied permission.

The committee recommends broadening by law in this state, along the lines of the New York statute, the liability of the owner to cover operation of his motor vehicle with his express or implied consent by any member of his family or other person, when the relationship of principal and agent is not present, modified however by the following provisions: That the driver of the car shall be made a party with the owner in any such action; that in event of judgment recourse shall first be had against the property of the driver; that an owner satisfying the judgment shall have recourse against the driver; and that the liability of the owner shall be limited to the usual amounts of five/ten thousand dollars for death or personal injury, and one thousand dollars for property damage.

An act embodying this recommendation will be found as Appendix F at page 89 of this report.

G. Liability for damages resulting from operation of a motor vehicle by an unlicensed minor should be determined; and statutory provision should be made that a person who has signed the application of a minor for a driving license and wishes to be relieved from the liability thereby incurred may procure such relief.

While the present law of the state establishes liability for the negligence of a licensed minor in operating a motor vehicle, there is no statutory provision for liability in the case of an unlicensed minor.

Likewise, the present law omits to provide relief for a person who has signed the application of a minor for a driving license and thereby assumed liability jointly and severally with the minor for the latter's negligence, and who wishes to be relieved of the liability so incurred.

The committee therefore recommends that the section of the vehicle act dealing with the licensing and liability of minor drivers be amended so as to supply these deficiencies as follows:

That liability for the negligence of an unlicensed minor in operating a motor vehicle shall be imputed jointly and severally to the minor and the parent, guardian or other legal custodian of the minor (except that when the unlicensed minor is operating the motor vehicle as agent or employee liability shall attach to the principal or employer), subject to the usual limitation of five/ten thousand dollars for death or personal injury and one thousand dollars for property damage; and

That a person who wishes to be relieved from the liability incurred by signing the application of a minor for a driving license shall be so relieved upon giving appropriate notice to the division of motor vehicles, which shall thereupon cancel such application and the license issued under it to the minor.

An act embodying these recommendations of the committee will be found as Appendix G at page 90 of this report.

D. All driving licenses of persons against whom final judgment establishing negligence in motor vehicle operation has been entered should be revoked unless the judgment is promptly satisfied; and all such persons should be required to furnish security as against public liability.

No phase of the investigation by the committee has been more searching or more thorough than its study of this question of financial responsibility for automobile accidents; and no principle stands out more clearly throughout the investigation than this—*that the prime purpose of all regulatory legislation regarding motor vehicles is and must be accident prevention and public safety.*

The committee's position is well expressed in the following excerpt: "Prevention should not be subordinated to indemnity. The evil to be remedied is not that certain individuals may not be indemnified for injuries suffered through the faults of others, but is that because of reckless and negligent operation of motor vehicles upon our highways and the disregard of laws many individuals are injured. If the evil is remedied—that is, if motor vehicle accidents are reduced in number—then the minor result of this evil will be reduced in at least the same proportion and it will be reduced in a way of utmost value for the saving of life and limb will be substituted for the palliative of assured indemnity. There can be no adequate indemnity for loss of life or for serious injury. Prevention of accidents, therefore, must be the real objective; and as to this we stand squarely on the platform of the National Conference on Street and Highway Safety." (Report of the Committee of Five.)

This fundamental principle—prevention of accidents—is the impelling motive of the present recommendation, just as it directly underlies every other recommendation contained in this report. The committee holds the principle to be basic, and considers that only upon it as a foundation can the construction of effective legislation for public safety be reared.

In compliance, therefore, with the specific mandate of the Legislature for a report on the advisability of the adoption of a law requiring financial security on the part of persons operating motor vehicles on the highways of this state, the committee recommends the enactment of a law to the following effect:

1. That when a final judgment establishing negligence in the operation of a motor vehicle shall have been entered against any person by any court in this state, it should be required that, within fifteen days from the date said judgment becomes final, the judgment shall be satisfied, to the amounts stipulated below, and to the same amounts and within the same time security against future liability shall be established covering losses of the judgment debtor and of the negligent driver if he is not the judgment debtor, shall be revoked.

2. That after revocation of licenses in such case, no new license should be issued to said judgment debtor or driver until the judgment shall have been satisfied and security against future liability shall have been established, as aforesaid, and until the applicant shall have demonstrated to the satisfaction of the Division of Motor Vehicles his ability and fitness to operate a motor vehicle with due regard to public safety.

3. That such judgment should be required to be satisfied, and such security against future liability should be required to be established, to the following amounts: In the case of death of or injury to one person, five thousand dollars; in the case of death of or injury to more than one person in the same accident, ten thousand dollars; in the case of property damage, one thousand dollars.

4. That in establishing the required security against future liability the usual choice between an insurance policy, a liability indemnity bond and a deposit of cash should be permitted.

5. That operation of a motor vehicle after such revocation of license should be declared a high misdemeanor and be punishable as such.

The committee believes that both as an accident prevention measure and as a means of furthering the indemnification of innocent victims of motor vehicle accidents, the recommendation here proposed is a long step in advance of similar legislation yet enacted in any other state in the Union.

Acts embodying these recommendations will be found as Appendices C, H and J at pages 82, 91 and 93, respectively, of this report.

APPENDICES

APPENDIX A

An act to amend section 142 of the California vehicle act, approved May 30, 1923, as amended, relating to the creation of a traffic and safety bureau in the division of motor vehicles, prescribing its powers and duties and making an appropriation therefor; and to accident reports.

The people of the State of California do enact as follows:

SECTION 1. Section 142 of the California vehicle act, approved May 30, 1923, as amended, is hereby amended to read as follows:

Sec. 142. Accident reports.

(*a*) The driver of any vehicle involved in an accident resulting in injuries or death to any person, shall within twenty-four hours forward a report of such accident to the division, except that when such accident occurs within an incorporated city or town such report shall be made within twenty-four hours to the police headquarters in such city or town. Every police department shall forward every such report, or a copy thereof, so filed with it to the division.

The division may require drivers involved in accidents to file supplemental reports and may require witnesses of accidents to render reports to it upon forms furnished by it whenever the original report is insufficient in the opinion of the division. Such report shall be without prejudice, shall be for the information of the division and the fact that such reports have been so made shall be admissible in evidence solely to prove a compliance with this section, but no such report or any part thereof, shall be admissible in evidence for any other purpose in any trial, civil or criminal, arising out of such accident.

(*b*) The division shall prepare and may supply to police and sheriff offices and other suitable agencies, forms for accident reports calling for sufficiently detailed information to disclose with reference to a highway accident the cause, conditions then existing and the persons and vehicles involved.

The division shall receive accident reports required to be made by this act and shall tabulate and analyze such reports and publish annually, or at more frequent intervals, statistical information based thereon as to the number, cause and location of highway accidents.

(*c*) There is hereby created a bureau to be known as the traffic and safety bureau of the division of motor vehicles. The superintendent of the bureau shall be appointed by the chief of the division of motor vehicles and shall hold office at the pleasure of, and receive a salary to be fixed by, the chief of the division of motor vehicles with the approval of the department of finance.

(*d*) The bureau herein created shall assume all of the duties now imposed upon the division of motor vehicles relating to traffic accident statistics, reports and information and such closely allied duties, as the chief of said division may designate; and shall make a thorough research and study of the causes of traffic accidents and the solution of traffic problems; and shall present to the Legislature at each session

thereof its recommendations for prevention of traffic accidents in the interest of public safety. In gathering information, reports and statistics the bureau shall have full authority to call upon any officer, agent or employee of the state, or of any political subdivision thereof, to furnish to said bureau all information, reports and statistics which the bureau may desire. Such information, reports or statistics must be furnished by the officer, agent or employee when called upon when and in such manner as the bureau may order or direct.

APPENDIX B

An act to amend section 61 of the California vehicle act, approved May 30, 1923, as amended, relating to applications for operators' and chauffeurs' licenses.

The people of the State of California do enact as follows:

SECTION 1. Section 61 of the California vehicle act, approved May 30, 1923, as amended, is hereby amended to read as follows:

Sec. 61. (*a*) Every application for an operator's or chauffeur's license shall be made upon the approved form furnished by the division and shall state whether the application is for an operator's license or a chauffeur's license.

Every application shall also contain the name, age, sex, and the residence address of the applicant, and whether or not the applicant has heretofore been licensed as an operator or chauffeur and if so when and by what state, and whether or not such license has ever been suspended or revoked and if so the date of and reason for such suspension or revocation; and shall also state whether or not the applicant has ever been convicted or fined for any violation of this act and if so the total number of times so convicted, or fined, the nature of each such conviction or violation for which fined, the name of the court in which each conviction was had, or fine imposed, and the approximate date of each; and also whether or not any judgment has ever been recovered, in any court, against the applicant for injury either to person or property, caused by the operation of any motor vehicle, together with the nature of each such judgment, the amount thereof, the court in which recovered, the approximate date thereof, and whether or not each such judgment has been satisfied.

(*b*) Every application shall be verified by the applicant before a person authorized to administer oaths and for the purposes of this section officers and employees of the division are hereby authorized to administer oaths without fee and the applications in addition to the foregoing matters, shall contain a statement as to the qualifications of the applicant for a license, including a statement as to the condition of the applicant's hearing and eyesight and whether such person has the normal use of both hands and both feet or has ever been afflicted with epilepsy, paralysis, insanity or other disability or disease affecting such person's ability to exercise reasonable and ordinary control over a motor vehicle while operating the same upon a public highway and whether such person has previously operated any motor vehicle and if so, for what length of time, and whether such person is able to understand highway warning and direction signs.

APPENDIX C

An act to amend sections 51, 66, 72 and 73 of the California vehicle act approved May 30, 1923, as amended, relating to the issuance, revocation and suspension of licenses and registration of motor vehicles.

The people of the State of California do enact as follows:

SECTION 1. Section 51 of the California vehicle act approved May 30, 1923, as amended, is hereby amended to read as follows:

Sec. 51. Failure to register or unlawful use—Penalties. It shall be unlawful and constitute a misdemeanor for any person to commit any of the following acts:

First—To operate or for the owner thereof to knowingly permit the operation of any motor vehicle, trailer or semi-trailer upon a public highway which shall not be registered or for which the registration fees have not been paid, when and as required by the provisions of this act;

Second—To operate or for the owner thereof to knowingly permit the operation of any vehicle unless there shall be attached thereto and displayed thereon when and as required by this act the registration certificate and registration plates or plate assigned thereto by the division for the current registration year;

Third—To display or cause or permit to be displayed or have in possession any canceled, revoked, suspended, altered or fictitious certificate of registration or ownership, number plate or operator's or chauffeur's license as the same are respectively provided in this act;

Fourth—To lend to or knowingly to permit the use of by one not entitled thereto any certificate of registration or ownership, number plate or operator's or chauffeur's license issued to the person so lending or permitting the use thereof;

Fifth—To display or to represent as one's own, any operator's or chauffeur's license not issued to the person so displaying the same;

Sixth—To fail or refuse to surrender to the division, upon demand, any certificate of registration or ownership, number plate or operator's or chauffeur's license which has been suspended, canceled or revoked as in this act provided;

Seventh—To use a false or fictitious name in any application for the registration of any vehicle or for an operator's or chauffeur's license, or to knowingly make a false statement or to knowingly conceal a material fact or otherwise commit a fraud in any such application;

Eighth—To alter, or to erase, or to remove from any operator's or chauffeur's license certificate any endorsement thereon of any revocation, suspension, conviction, or fine, made by order of court, or of the division of motor vehicles.

SEC. 2. Section 66 of said act is hereby amended to read as follows:

Sec. 66. (*a*) The division shall issue to every person licensed as an operator, an operator's license, and to every person licensed as a chauffeur, a chauffeur's license.

(*b*) Every such license shall bear thereon the distinguishing number assigned to the applicant and shall contain the name, age, and residence address of the person to whom the license is issued and a brief description of such person for the purpose of identification, and shall also contain a space for the signature of the licensee; and thereafter there shall be endorsed thereon a record of each revocation and suspension thereof by the court so revoking or suspending and of each violation of this act in which conviction was had or fine imposed when license was not revoked or suspended; and when suspended or revoked by the division of motor vehicles a record thereof shall be endorsed thereon by the division.

SEC. 3. Section 72 of said act is hereby amended to read as follows:

Sec. 72. (*a*) Whenever any person holding an operator's or chauffeur's license shall be convicted of a violation of section 113 or 121 of this act prohibiting speeding or reckless driving, the court may in its discretion suspend the license of such person for a period not to exceed thirty days upon a first conviction, for a period not to exceed sixty days upon a second conviction and for a period not to exceed twelve months for a third or subsequent conviction.

(*b*) Whenever any person holding an operator's or chauffeur's license shall be convicted of a violation of section 112 of this act declaring it unlawful to drive a vehicle while intoxicated the court shall suspend the license of such person for a period of one year and shall immediately thereafter notify the division of such conviction and suspension and shall revoke such license upon a second conviction.

(*c*) Conviction had prior to the time this act takes effect shall not be considered in determining the number of convictions hereinbefore referred to.

(*d*) Whenever any court shall suspend an operator's or chauffeur's license as in this section provided, the court shall require such license certificate to be produced and surrendered to the court, and the court shall retain such license certificate during the period of suspension, returning the same to the owner at the end of such period, only, however, after a record of such suspension has been endorsed thereon by order of the court.

(*e*) In case of any conviction had or fine imposed for any violation of this act the court shall endorse a record thereof upon the operator's or chauffeur's license, as the case may be, whether such license was suspended as provided in paragraph (*d*) of this section, or not.

SEC. 4. Section 73 of said act is hereby amended to read as follows:

Sec 73. (*a*) The division shall forthwith revoke the license of any person, for a period of twelve months, upon receiving satisfactory evidence of the conviction, or of the entry of a plea of guilty and sentence thereupon, or of the forfeiture of bail of any such person, charged with the commission of any of the following crimes:

(1) Manslaughter, resulting from the operation of a motor vehicle.

(2) Any crime constituting a felony under the California vehicle act or of any other felony in the commission of which a motor vehicle is used.

(3) Convictions upon three charges of reckless driving all within a period of twelve months from the time of the first conviction.

(*b*) The division may conduct an investigation and hearing to determine whether the license of an operator or chauffeur shall be suspended or revoked in any of the following events:

(1) Upon receiving a verified complaint that any person is afflicted with such mental or physical infirmities or disabilities as would constitute ground for refusal of a license under this act.

(2) Upon receiving a verified complaint that any person has driven a motor vehicle in a reckless or negligent manner, and has thereby caused death or injury to any person or serious damage to property and upon investigation following such complaint, inquiry shall be made, and the division shall have jurisdiction to determine whether the license of any operator or chauffeur involved in or contributing to such accident shall be suspended or revoked, and no testimony or record of suspension or revocation of a license by the division following such complaint shall be admissible as evidence in any court in any action at law for negligence arising out of or involving such accident, nor shall any testimony or record of a conviction of any person of a misdemeanor under the California vehicle act be admissible as evidence in a civil action brought against the person so convicted.

(3) Upon receiving a verified complaint that an operator or chauffeur is an habitual reckless, negligent or incompetent driver of any motor vehicle.

(*c*) The chief of the division shall determine the sufficiency of any complaint filed hereunder, and in his discretion shall have power to set a time for hearing in the county wherein the person complained of shall reside, and such person shall be entitled to at least ten days' previous notice of such hearing from the division and such hearing shall be held by the chief of the division or by any person or persons not exceeding three, officers or employees of the division whom he may designate.

(*d*) The chief of the division or the person or persons designated by him and holding such hearing may summon witnesses in behalf of the state and such witnesses as may be designated by the person under investigation, and may administer oaths and take testimony or cause depositions to be taken, and the supreme court, any district court of appeal or any superior court shall have jurisdiction upon the application of the division to enforce all lawful orders of the division under this section. The failure of the respondent to appear at the time and place of hearing after notice, as provided in this section, shall not prevent the hearing, the taking of testimony and determination of the matter as herein provided. The fees for the attendance and travel of witnesses shall be the same as for witnesses before the superior court and shall be paid by the state upon demand by the division filed with the controller.

(*e*) Upon the conclusion of such hearing, the chief of the division or the person or persons holding such hearing on his behalf shall prepare findings based upon the evidence received and considered. If the findings are to the effect that the person referred to therein is incompetent or is unfit to operate a motor vehicle upon any of the grounds upon which license might be refused, as stated in this act, the chief of the division upon a review of such findings shall have authority to forthwith revoke the license of such person, or if the findings are to the effect that the person therein referred to has by reason of negligent or reckless driving endangered life, limb or property or has thereby caused loss of life or

injury to person or property, the chief of the division upon a review of such findings shall have power to suspend the license of such person for a period not exceeding six months, or may revoke such license, and in either event shall require that such license certificate and any chauffeur's badge issued to such person be surrendered to the division.

(*f*) Upon the expiration of the period of the suspension of any license as hereinbefore in this section provided for, the division shall return to the licensee his license certificate, or in its discretion may issue to him a new certificate; and in like manner the division shall return to any chauffeur, whose license badge and certificate may have been forwarded to the division upon suspension of his license, such license badge and certificate, or issue to such licensee a new badge and certificate; *provided, however*, that a record of such suspension shall be first endorsed, by the division, on each such certificate.

(*g*) The operator's or chauffeur's license and all of the registration certificates, of any person, in the event of his failure to satisfy every judgment within fifteen days from the time it shall have become final, rendered against him by a court of competent jurisdiction in this or any other state, or in a district court of the United States, for damages on account of personal injury, or damages to property in excess of one hundred dollars, resulting from the ownership or operation of a motor vehicle by him, his agent, or any other person with the express or implied consent of the owner, shall be forthwith suspended by the chief of the division of motor vehicles, upon receiving a certified copy of such final judgment or judgments from the court in which the same are rendered and shall remain so suspended and shall not be renewed nor shall any other motor vehicle be thereafter registered in his name while any such judgment remains unsatisfied and subsisting, and until the said person gives proof of his ability to respond in damages, as defined in section 36½ of this act, for future accidents. It shall be the duty of the court in which any such judgment is rendered to forward immediately to such chief of the division of motor vehicles a certified copy of such judgment or a transcript thereof. In the event the defendant is a nonresident it is the duty of the chief of the division of motor vehicles to transmit to the commissioner of motor vehicles of the state of which the defendant is a resident a certified copy of the said judgment. If after such proof has been given, any other such judgment shall be recovered against such person, for any accident occurring before such proof was furnished, such license and certificates shall again be and remain suspended while any such judgment remains unsatisfied and subsisting; *provided, however*, that

(1) When five thousand dollars has been credited upon any judgment or judgments rendered in excess of that amount for personal injury to or the death of one person as the result of any one accident, or

(2) When subject to the limit of five thousand dollars for each person, the sum of ten thousand dollars has been credited upon any judgments rendered in excess of that amount for personal injury to or the death of more than one person as the result of any one accident, or

(3) When one thousand dollars has been credited upon any judgment or judgments rendered in excess of that amount for damage to property as the result of any one accident, resulting from the ownership or operation of a motor vehicle by such judgment debtor, his agent or

any other person, with his express or implied consent, then and in such event, such payment or payments shall be deemed a satisfaction of such judgment or judgments for the purposes of this section only.

If any such motor vehicle owner or operator shall not be a resident of this state, the privilege of operating any motor vehicle in this state and the privilege of operation within the state of any motor vehicle owned by him shall be withdrawn, while any final judgment procured against him for damages, including personal injury or death caused by the operation of any motor vehicle, in this state or elsewhere, shall be unsatisfied and subsisting, and until he shall have given proof of his ability to respond in damages for future accidents as prescribed in section 36½ of this act.

APPENDIX D.

An act to amend section 36 of the California vehicle act, approved May 30, 1923, as amended, relating to the applications for registrations of motor vehicles.

The people of the State of California do enact as follows:

SECTION 1. Section 36 of the California vehicle act, approved May 30, 1923, as amended, is hereby amended to read as follows:

Sec. 36. (*a*) Every owner of a motor vehicle, trailer or semi-trailer which shall be operated upon the public highways of this state shall for each such vehicle owned, except as herein otherwise provided, apply to the division for the registration thereof.

(*b*) Application for the registration of a vehicle herein required to be registered shall be made upon the appropriate form furnished by the division and shall contain the name and address of the owner and legal owner, also a description of the vehicle, including the name of the maker, the motor number, the date first sold by the manufacturer or dealer to the consumer and such further description of the vehicle as shall be called for in the form, and such other information as may be required by the division.

(*c*) In the event that the vehicle to be registered should be a specially constructed, reconstructed or an imported vehicle, such fact shall be stated in the application, and upon the registration of every imported motor vehicle which has been registered theretofore in any other state or country, the owner shall surrender to the division all number plates, seals, certificates of registration or other evidences of such former registration as may be in the applicant's possession or control.

(*d*) The provisions of this act requiring the registration of certain vehicles shall not apply to special mobile equipment nor to implements of husbandry temporarily drawn, moved or otherwise propelled upon the public highways.

(*e*) The application herein provided for shall be accompanied by a statement as to the amount of public liability motor vehicle insurance carried by the applicant, if any, and the name of the insurance carrier thereof.

APPENDIX E.

An act to add a new section to the Civil Code to be numbered 1714½, relating to negligence upon the part of state and subordinate officers, agents and employees.

The people of the State of California do enact as follows:

SECTION 1. A new section is hereby added to the Civil Code to be numbered 1714½ and to read as follows:

1714½. Hereafter the state, county and each and every other political subdivision thereof, shall be responsible to every person who sustains any damage by reason of death, or injury to person or property, as a result of the negligent operation of a motor vehicle, by any officer, agent, or other employee of the state, county or other political subdivision thereof, as the case may be; and such person may sue the state, county, or other political subdivision, as the case may be, in any court of competent jurisdiction in this state, in the manner directed by law. In every case where a recovery is had under the provisions of this section against the state, county or other political subdivision thereof, the state, county, or other political subdivision, shall be subrogated to all the rights of the person injured, against the officer, agent or other employee, as the case may be, and may recover, from such officer, agent or other employee, the total amount of any judgment and costs recovered against the state, county or other political subdivision, in such case together with costs therein.

APPENDIX F.

An act to add a new section to the Civil Code to be numbered 1714¼, relating to negligence.

The people of the State of California do enact as follows:

SECTION 1. A new section is hereby added to the Civil Code to be numbered 1714¼ and to read as follows:

1714¼. Every owner or legally registered possessor of a motor vehicle is responsible in damages, for the death, or injury to the person or property, of another, occasioned by the want of ordinary care or skill in the management thereof, by him, his minor child (legally under his care and custody), his agent, or any other person operating the motor vehicle with the express or implied consent of the owner or legally registered possessor, as the case may be.

APPENDIX G.

An act to amend section 62 of the California vehicle act, approved May 30, 1923, as amended, relating to application for operator's and chauffeur's license, and to the liability of a parent, guardian, or employer for negligence of a minor in the operation of a motor vehicle.

The people of the State of California do enact as follows:

SECTION 1. Section 62 of the California vehicle act, approved May 30, 1923, as amended, is hereby amended to read as follows:

Sec. 62. (*a*) The application to the division of any minor for an operator's license shall not be granted unless such application is signed by both the father and mother of the applicant if both the father and mother are living and have custody of the applicant, otherwise by the parent, guardian, employer or other person having the custody of such minor.

(*b*) Any negligence of a minor so licensed in driving a motor vehicle upon a public highway shall be imputed to the person or persons who shall have signed the application of such minor for said license, which person or persons shall be jointly and severally liable with such minor for any damages caused by such negligence.

(*c*) Any person who shall have signed the application of a minor for an operator's license under this section and who desires to be relieved from the joint and several liability imposed by reason of having signed such application, may notify the division of such fact and thereupon the division shall cancel the license of such minor and thereafter the said person who originally signed the application shall be relieved from the liability imposed in subdivisons (*a*) and (*b*) of this section, on account of subsequent negligent operation of a motor vehicle by said minor. Any minor whose license has been canceled as above provided may obtain a new license only by making a new application under the conditions set forth in subdivisions (*a*) and (*b*) of this section.

(*d*) Also any negligence of a minor, whether licensed or not under this act, in driving a motor vehicle upon a public highway with the express or implied permission of a parent or parents having custody of such minor, shall be imputed to such parent or parents, who shall be jointly and severally liable with such minor for any damages caused by such negligence, except in the event the minor is driving a motor vehicle owned by an employer who is other than the parent or parents.

(*e*) Unless the minor be acting as the agent of a parent, guardian or employer, such parent, guardian or employer, as the case may be, shall not incur liability under this section in any amount exceeding five thousand dollars for injury or death to one person or ten thousand dollars for injury or death of more than one person in any one accident or one thousand dollars for damage to property in any one accident.

APPENDIX II

An act to add two new sections to the California vehicle act, approved May 30, 1923, as amended, to be numbered 36½ and 36¾, relating to registration of motor vehicles.

The people of the State of California do enact as follows:

SECTION 1. A new section is hereby added to the California vehicle act, approved May 30, 1923, as amended, to be numbered 36½ and to read as follows:

Sec. 36½. Proof of ability to respond in damages when required by this act, shall mean proof of ability to respond in damages, resulting from the ownership, or operation, of a motor vehicle, and arising by reason of personal injury to, or death of, any one person, of at least five thousand dollars, and, subject to the limit of five thousand dollars for each person injured or killed, of at least ten thousand dollars for such injury to, or the death of, two or more persons in any one accident, and for damage to property (in excess of one hundred dollars) of at least one thousand dollars resulting from any one accident. Such proof of ability to respond in damages may be given either by

(1) The written certificate or certificates of any insurance carrier duly authorized to do business within the state, that it has issued to or for the benefit of the person named therein a motor vehicle liability policy or policies as defined in section 36¾ of this act, which, at the date of said certificate or certificates is in full force and effect, and designating therein by explicit description or by other appropriate reference all motor vehicles with respect to which coverage is granted by the policy certified to. The chief of the division of motor vehicles shall not accept any certificate or certificates unless the same shall cover all motor vehicles registered in the name of the person furnishing such proof. Additional certificates as aforesaid shall be required as a condition precedent to the registration of any additional motor vehicle or motor vehicles in the name of such person required to furnish proof as aforesaid. Said certificate or certificates shall certify that the motor vehicle liability policy or policies therein cited shall not be canceled except upon ten days prior written notice thereof to the chief of the division of motor vehicles; or

(2) The bond of a surety company duly authorized to do business within the state or a bond of individual sureties each owning unencumbered real estate approved by a judge of a court of record which such bond shall be conditioned for the payment of the amount specified in this section, and providing for the entry of judgment on motion of the state in favor of any holder of any final judgment on account of damage to property over one hundred dollars in amount, or injury to any person caused by the operation of such person's motor vehicle, in the same manner as provided in section 942 of the Code of Civil Procedure for the entry of judgment upon appeal bonds; or

(3) Evidence presented to the chief of the division of motor vehicles of a deposit by such person with the state treasurer of a sum of money, the amount of which money shall be eleven thousand dollars. But the chief of the division of motor vehicles shall not accept a deposit of money where any judgment or judgments theretofore recovered against such person as a result of damages arising from the operation of any motor vehicle shall not have been paid in full. The treasurer of the state shall accept any such deposit and issue a receipt therefor.

SEC. 2. A new section is hereby added to said act to be numbered section 36¾, and to read as follows:

Sec. 36¾. "Motor vehicle liability policy," as used in this act, shall be taken to mean a policy of liability insurance issued by an insurance carrier authorized to transact business in this state, to the person therein named as insured, which policy shall designate, by explicit description or by appropriate reference, all motor vehicles with respect to which coverage is intended to be granted by said policy, and shall insure the insured named therein, and any other person using or responsible for the use of any such motor vehicle, with the consent, express or implied, of such insured, against loss from the liability imposed upon such insured by law or upon such other person for injury to, or death of, any person, other than such person or persons as may be covered as respects such injury or death by any workmen's compensation law, or damage to property, except property of others in charge of the insured or the insured's employees growing out of the maintenance, use or operation of any such motor vehicle in the United States of America; or which policy shall, in the alternative, insure the person therein named as insured against loss from the liability imposed by law upon such insured for injury to or death of any person, other than such person or persons as may be covered as respects such injury or death by any workmen's compensation law, or damage to property, except property of others in charge of the insured or the insured's employees, growing out of the operation or use by such insured of any motor vehicle, except a motor vehicle registered in the name of such insured, and occurring while such insured is personally in control, as driver or occupant, of such motor vehicle within the United States of America, to the amount or limit of five thousand dollars, exclusive of interest and costs, on account of injury to or death of any one person, and, subject to the same limit as respects injury to or death of one person, of ten thousand dollars, exclusive of interest and costs, on account of any one accident resulting in injury to or death of more than one person; and of one thousand dollars for damage to property of others, as herein provided, resulting from any one accident; or a binder pending the issuance of any such policy, or an endorsement to an existing policy as hereinafter provided; *provided*, that this section shall not be construed as preventing such insurance carrier from granting any lawful coverage in excess of or in addition to the coverage herein provided for, nor from embodying in such policy any agreements, provisions or stipulations not contrary to the provisions of this act and not otherwise contrary to law.

APPENDIX J

An act to amend section 74 of the California vehicle act, approved May 30, 1923, as amended, relating to penalties for driving motor vehicles while license is suspended or revoked.

The people of the State of California do enact as follows:

SECTION 1. Section 74 of the California vehicle act approved May 30, 1923, as amended, is hereby amended to read as follows:

SEC. 74. Any person who drives a motor vehicle, after his operator's or chauffeur's license has been revoked or suspended, by reason of his failure to pay a final judgment, within fifteen days, rendered against him for injury resulting from the negligent operation by him, his agent, or any other person with his consent, express or implied, or for any other reason as provided in this act, and while such license remains revoked or suspended, is guilty of a misdemeanor and upon conviction therefor shall be punished by imprisonment in the county jail for not to exceed one year or by fine not to exceed one thousand dollars or by both such fine and imprisonment.

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Report of the Joint Committee
Of the Senate and Assembly
Dealing With the

WATER PROBLEMS OF THE STATE

Submitted to the Legislature
of the
State of California

JANUARY 18, 1929

64918

MEMBERS OF THE COMMITTEE

SENATE MEMBERS

RALPH E. SWING, *vice chairman*.....San Bernardino
H. C. NELSON.....Eureka
WILL R. SHARKEY.....Martinez
EDWIN A. MUELLER.....El Cajon

ASSEMBLY MEMBERS

B. S. CRITTENDEN, *chairman*.....Tracy
VAN BERNARD.....Butte City
E. G. ADAMS, *secretary*.....Livingston
F. W. MIXTER.....Exeter

Assembly Concurrent Resolution No. 30—Providing for the appointment of a committee on water problems.

WHEREAS, It is necessary that the Legislature of the State of California have available adequate information so as to enable its members to consider proper legislation looking to the adoption of a state-wide plan for the conservation and use of the waters of the state; now, therefore, be it

Resolved by the Assembly, the Senate concurring, That a committee of eight members, consisting of four members of the Assembly to be appointed by the speaker of the Assembly, and four members of the Senate to be appointed by the president of the Senate, be appointed to make an investigation of the water problems of the state and to recommend to the Legislature of the State of California at the forty-eighth session thereof some state-wide policy for the conservation and use of the waters of the state; and be it further

Resolved, That said committee shall proceed to organize by the election of one of its members as chairman and by the election of a secretary, and shall proceed with said investigation in such manner as may be determined by said committee; and be it further

Resolved, That each department, board, commission or officer of the State of California, whenever requested to do so by said committee, shall furnish to said committee such assistance as it may require; and be it further

Resolved, That said committee is hereby authorized to hold public hearings at any place in the State of California at which hearings the people shall have opportunity to present their views to the committee; and be it further

Resolved, That said committee is hereby authorized and empowered to do any and all things necessary to make a full and complete investigation of the matters herein referred to and is hereby authorized and empowered to require the production of books, agreements, documents and papers of every kind; to issue subpoenas and to compel the attendance of witnesses, and to procure testimony. Each of the members of said committee is hereby authorized to administer oaths, and all the provisions of article eight of chapter two, title one, part three of the Political Code of the state relative to the attendance and assemblage of witnesses before the Legislature and committees thereof, shall apply to the committee appointed under this resolution. The said committee is hereby given leave to sit during the session of the Legislature, during the recess thereof and during the interval between sessions thereof, at any place in the state as said committee shall from time to time determine.

LETTER OF TRANSMITTAL

January 18, 1929.

To the Members of the Legislature, State of California,
Forty-eighth Session, 1929:

Your Joint Committee of the Senate and Assembly has the honor to submit to you its report on the water problems of the state. In the preparation of its report it has endeavored to study carefully the various reports made to the Legislature during the past eight years by the State Engineer, to have additional studies made under his direction; also to appoint a Legal Advisory Committee and have made available to the Legislature a report from it, and to have other reports and data assembled so that the members of the Legislature and the people of the state might have the benefit of this information and be better prepared to consider any legislation pertaining to the state's water problems.

Your committee has also in its report made definite recommendations pertaining to a statewide policy for the conservation and use of the state's waters. In making such recommendations the committee has followed your instructions in the resolution providing for its appointment. It is, however, fully cognizant of the magnitude and complexity of the problem and the far-reaching effects of adopting a new policy on the part of the state as well as the danger in doing nothing.

The committee wishes to call your attention to some of the important reports which have been filed with it, which may be of value to other members, should they desire to study them. Too much credit can not be given the many reports which have been presented from time to time to the Legislature on water problems by the State Engineering Department.

PARTIAL LIST OF OTHER REPORTS

Salt Water Problems of San Francisco Bay and Delta, by Thomas H. Means.

Report of Legal Advisory Committee to Joint Legislative Committee, dated October 27, 1928.

Report on Kennett Reservoir Development, an Analysis of Methods and Extent of Financing by Electric Power Revenue, by Lester S. Ready, Consulting Engineer, under the direction of Edward Hyatt, State Engineer.

The stenographic report of the proceedings before your committee in San Francisco on February 20, 21 and 22, 1928, and also April 16, 1928, and November 23, 1928.

Memorandum to the Joint Legislative Committee Pertaining to the American River, by A. M. Barton, Chief Engineer of the State Reclamation Board.

Report of Irrigation Investigation in California, by the United States Department of Agriculture. 1901. Bulletin 100.

Your committee wishes to mention the valuable assistance of all state departments called upon, and particularly the Department of Public Works, including Mr. B. B. Meek, its director, and State Engineer Edward Hyatt and his assistants, and the members of the Legal Advisory Committee, namely, Messrs. Henry E. Monroe, chairman, F. G. Athearn, Louis Bartlett, W. B. Bosley, Spencer Burroughs, A. L. Cowell, Homer J. Hankins, S. B. Robinson, Edward F. Treadwell and Samuel C. Wiel, all of whom have freely given the committee able assistance. The committee wishes to express its gratitude to the various chambers of commerce and other organizations throughout the state for the splendid assistance they have given in furnishing a means of contact with the public generally. The press of the state has materially helped to make our public meetings successful; in fact, throughout the state there seems to have been a friendly attitude toward the work of the committee and a spirit of helpfulness.

B. S. Crittenden, Chairman,
Ralph E. Swing, Vice Chairman,
E. G. Adams, Secretary,
Van Bernard,
F. W. Mixter,
H. C. Nelson,
Will R. Sharkey,
Edwin A. Mueller.

METHODS PURSUED BY COMMITTEE

Promptly after the appointment of the various members by the Lieutenant Governor and the Speaker, they met in Sacramento and organized. They also mapped out a plan of procedure.

The study involved covered such a wide range and the data to be obtained was so extensive and the problems involved were so numerous and complex that it was with some difficulty that the committee could determine where to begin and how to proceed.

PHYSICAL CONDITIONS.

It was obvious almost from the beginning that the committee should obtain a physical picture of the portions of the state that are affected by present water developments or that might be affected, and the parts also that produce the water supply. It was also clear that the various reports made to the Legislature since 1921 by the State Department of Engineering pertaining to the water problems should be given exceptionally careful study. Mr. Paul Bailey, State Engineer, at the first meeting of this committee, suggested that the best results would be obtained by the committee, so far as possible, by viewing dam and reservoir sites in the mountains mentioned in the report, as well as viewing developments in all the valleys of the state which the report had included.

Mr. Edward Hyatt, the State Engineer, following Mr. Paul Bailey, readily agreed to this plan and personally accompanied the committee on various tours of investigation from Eureka in the north down through the Sacramento and San Joaquin valleys and finally finishing at San Diego.

These investigation tours were so planned that during the day the committee would be shown a particular dam or reservoir site or a particular water development or physical condition mentioned in the report, and in the evening a public meeting would be held in the community the committee was visiting and the State Engineer would publicly explain his report as it applied to what had been seen during the day.

These meetings were well attended by the public, and the committee enjoyed a free exchange of views on water problems between the State Engineer and those present.

This method was followed at meetings held at Eureka, Redding, Red Bluff, Oroville, Marysville, Placerville, Grass Valley, Willows, Sacramento, Stockton, Richmond, Pittsburg, San Francisco, Merced, Modesto, Fresno, Delano, Porterville, Visalia, Hanford, Tulare, Bakersfield and other places.

The same method was also followed at meetings held in Los Angeles, San Bernardino, Riverside, Santa Ana, Fallbrook and San Diego, the water problems of the southern part of the state being, of course, of different nature to a large extent from those in the north, but are just as acute, important and serious, as will hereinafter appear.

ADDITIONAL REPORTS REQUIRED

Before the committee had proceeded far in its work it became obvious that a clear understanding should be had of the law applicable to the problems under consideration, hence the committee authorized its chairman to invite eleven well known attorneys to constitute a Legal Advisory Committee, to advise it as to the present status of the law.

This Legal Advisory Committee is composed of:

Messrs. Henry E. Monroe, Chairman,
F. G. Athearn,
Louis Bartlett,
W. B. Bosley,
Spencer Burroughs,
A. L. Cowell,
Homer J. Hankins,
S. B. Robinson,
Edward F. Treadwell,
Samuel C. Wiel.

Their report is marked Exhibit "A" and is affixed hereto and thereby made a part of the report of this committee.

It also appeared to the committee that more detailed study should be made of the revenue which might be obtained by the state from incidental power to be developed at any one of the dam sites and also the economic burden which the state would have to assume under the different methods of developing and handling of power. Kennett Dam was chosen as typical as to power possibilities and a report was prepared by Mr. Ready, under the direction of State Engineer Hyatt, and is marked Exhibit "B," attached hereto, and made a part of this report. Various supplemental reports have been prepared by the State Engineer at the request of the committee, as the result of its study.

PREVIOUS INVESTIGATIONS

It has been in the minds of many of our thoughtful citizens throughout the state for many years that some plan for the orderly development of the water resources of the state should be adopted.

In 1901 the United States Department of Agriculture made a report of irrigation investigations in California under the direction of Mr. Elwood Mead. This investigation was brought about by special requests of leading citizens of California. Their communication to Dr. A. C. True, Director of Agriculture, was as follows:

To Dr. A. C. True,
Director, Office of Experiment Stations,
U. S. Department of Agriculture:

The undersigned earnestly desire that Mr. Elwood Mead be detailed by the department to conduct a series of irrigation investigations in California, and trust that you may feel justified in forwarding this request to the Honorable Secretary of Agriculture with your approval. We have, of course, ascertained that the proposed detail will not be contrary to Mr. Mead's inclination or judgment.

We respectfully submit that nowhere in America are there irrigation problems more important, more intricate, or more pressing than in California. Neither are there any whose study would be more greatly instructive. We can offer, we presume, examples of every form of evil which can be found in Anglo-Saxon dealings with water in arid and semiarid districts.

GREAT SUMS HAVE BEEN LOST IN IRRIGATION ENTERPRISES. STILL GREATER SUMS ARE ENDANGERED. WATER TITLES ARE UNCERTAIN. THE LITIGATION IS APPALLING.

Among the things necessary to be known before we can hope for well-considered legislation upon the conservation and distribution of our waters are the following:

First. The amount of water in the streams.

Second. The duty of water in the different irrigation basins.

Third. The claims upon the water, collated by streams and not by counties as now.

Fourth. The nature of water right titles.

Fifth. The adjudicated claims upon the waters.

Sixth. The lands now irrigated and susceptible of irrigation.

Seventh. The possible increase of water for beneficial use by storage in each system.

Eighth. The extent to which the irrigable area can be increased by better methods of distribution and use.

(Signed by) E. J. Wickson, acting director, University of California Experiment Station; J. A. Filcher, manager State Board of Trade; William Thomas; David Starr Jordan, president, Leland Stanford Junior University; E. B. Pond, president San Francisco Savings Union; William Alvord, president, Bank of California; Charles H. Gilbert, vice president California Academy of Sciences; Marsden Manson; T. A. Kirkpatrick, vice president P. C. M. M. D. Company; E. E. Patten; Grant S. Taggart; Frank Soule, professor of civil engineering, University of California; Julius Kahn; Victor H. Metcalf; German Savings and Loan Society, by B. A. Becker, president; E. J. Le Breton, president French Savings Bank of San Francisco; California Safe Deposit and Trust Company; W. E. Brown, vice president Crocker-Woolworth National Bank; Hibernia Savings and Loan Society, by Robert J. Tobin, secretary; M. H. De Young, San Francisco Chronicle; J. M. Gleaves, president California Water and Forest Society; David M. de Long, manager Nevada and Monette Placer Mines; R. H. Goodwin, United States Deputy Mineralogical Surveyor; Frank W. Smith; Ernst A. Denicke, president Germania Trust Company; C. E. Grunsky, civil engineer; George C. Perkins; Andrew W. Kiddie, United States Deputy Mineralogical Surveyor.

In 1913 another investigation was made by the State of California. The report made by Dr. Mead pursuant to this request is very comprehensive and is on file with the United States Department of Agriculture, known as Bulletin No. 100.

Following this federal report other investigations and studies of the water problem were carried on by the State of California, which culminated in 1921 in a general demand for an investigation of the water resources of California, and numerous appropriations and investigations were made, all of which show the important part that water plays in the economic activities of the state.

GENERAL DEVELOPMENT

California is an empire in the making. Since the days of the padre there has been a continuous development of the agricultural lands of the state. In order to do that, reclamation of lands from overflow was necessary. Provisions for flood control to prevent storm waters inundating cities and valleys have been made. The state being semi-arid, irrigation has been gradually developed for summer cropping. The growth of our large cities has required the storage and transportation of domestic water supply and the building of large dams for the development of electric energy. Much of our water law rose out of conflicting claims between miners subsequent to the discovery of gold. These developments have continued steadily with the growth of the state.

LACK OF COORDINATION IN PAST DEVELOPMENT OF THE STATE RECLAMATION

In the beginning of the reclaiming of the delta of the Sacramento and San Joaquin rivers and other lands, individuals and small districts built levees around their property until dozens of reclamations were made, each without regard to the other. Thereafter it became a struggle between them for existence, because each reclamation project deterred the flow of the river, raised the water level, and caused the lower levees to break. This continued to a point where it became disastrous to the lowlands.

STATE POLICY OF RECLAMATION AND FLOOD CONTROL

The state early adopted a policy of flood control on the Sacramento and San Joaquin rivers. It cooperated with the federal government and the landowners along these streams and proceeded to control the height to which levees on the rivers might be raised.

In other words, it made the delta and Sacramento and San Joaquin valleys possible for reclamation by individuals or districts. The state also contributed a considerable sum toward flood control in Los Angeles County.

IRRIGATION DEVELOPMENT

The development of water for irrigation of agricultural lands in the Sacramento and San Joaquin valleys has been gradual, but extensive. It has been done by individuals, associations and various types of irrigation districts. Water for some of these developments is pumped from rivers directly to the lower levels. Some of them pump their water from subterranean sources. A more general practice perhaps is to store water in the high elevations nearest the valleys and to transport it to the lands in summer as required. All of these developments have been worked out, each as a single unit, without regard to their effects upon any other irrigation system or the needs of any other person or persons. In southern California conservation of the flood waters is effected by spreading such waters upon the debris cones at or near the mouths of the streams.

MUNICIPALITIES AND POWER COMPANIES

Municipalities and power companies have added to the complexity of the situation by constructing huge dams in the higher elevations for the storage and transportation of water for domestic purposes or the development of electric energy for general public use.

Each and all of these developments have been the result of the great development of the population of the state. They are the products of the economic needs of the state, but each and all of them in their construction and operation have had in mind only the success of the individual project.

None of them has been installed, developed, constructed or operated in coordination with the interests of any other part of the state. Only the persons to be served by the individual project have been considered.

Such developments are not to be condemned but are indicative of the industry of our people; they have created unlimited wealth for the state and made possible the growth of great cities and numerous towns.

WHY THIS INVESTIGATION?

The intensive development before mentioned, desirable though it may be, has brought about many physical changes. New conditions have been created.

Reclamation in the Sacramento Valley and dredging of the mouth of the Sacramento and San Joaquin rivers has caused storm waters to rush more rapidly to the sea. The intensive development of irrigation in the Sacramento and San Joaquin valleys and the storage of water for power and domestic uses has drawn upon the summer flow of those streams until the supply of fresh water in the delta channels in summer months has been materially decreased.

The manner in which present conditions in the delta may have been changed from their natural state is discussed in the report of Thomas H. Means on the "Salt Water Problem," which report is hereto annexed, marked Exhibit "C."

In the San Joaquin Valley from Fresno south practically the entire surface run-off from the tributary mountains is now utilized except in case of extreme floods, and the pumping of underground water is relied upon to sustain the farm areas as well as the towns that have been established therein. Literally thousands of wells are being pumped to furnish necessary water throughout the greater portion of the growing season in this area. All of the towns of the San Joaquin Valley obtain their domestic supply from wells.

By reason of these conditions the ground water levels from Kings River south are falling. In many improved localities this is true to such a serious and alarming extent that federal farm loans have been discontinued. It is not a question there of irrigating new areas that is involved so much as the maintaining of existing developments.

In Bulletin No. 12 of the California Engineering Department, on page 24, it is stated: "Large areas deriving their supply from underground sources are facing a dropping ground-water plane. These areas are extending as their communities expand. Without additional supplies, well levels in these regions will continue to drop until either the underground basins are exhausted or the cost of pumping water to the ground surface exceeds its value."

Again on page 25 it says "Not over two-thirds of the area now under irrigation in California can obtain water as needed, with reasonable certainty."

Quoting again on page 22 of the same report, "Practically all of the summer flow of California streams that are accessible is now in use."

That the limit of development which can safely be made by the individual enterprises has now been reached is probably best shown by the institution of vast numbers of legal controversies between cities and others, power companies and other appropriators, between the delta interests and all irrigators or appropriators in the Sacramento and San Joaquin valleys.

Perhaps this is best illustrated by a recent suit filed in the superior court in the county of San Joaquin, in which there are 500 party plaintiffs against approximately 500 party defendants. Of course, it is not the duty of this committee to influence any action now in the courts. We merely mention this fact as illustrative of what seems to be the beginning of an era of endless litigation, and to show that the water

problems are acute. Already the scarcity of water is alarming the users in the different parts of the state. It is obvious that development has reached its maximum under present conditions.

It is obvious from the reports and from common knowledge, and so far as we know it is not disputed, that the development of the Sacramento and San Joaquin valleys and in the San Francisco Bay section has brought about a dangerous encroachment of salt water, a depletion of the water supply in the San Joaquin Valley for lands now under development; and with no reserve for further growth, and shortening of the distance on the river in which navigation can be enjoyed. In addition many cities and highly developed communities are annually menaced by floods, a great industrial district without a sufficient fresh water supply, a depletion of the water supply available for individual development and a continuing condition of legal strife involving water rights, all due largely to water consumed by various methods of development.

In other words, the great interior basin of California and portions of the territory surrounding San Francisco Bay have almost reached the limit of economic development of its water resources under the present policy of the state and under present conditions. Large agricultural areas and present investments are in danger of retrogression and depreciation; and all interests are more or less unstable on account of threatening litigation and uncertainty of future water supply.

SOUTHERN CALIFORNIA-COLORADO RIVER

South of Tehachapi lies an area known as the coastal plain. It comprises one of the richest and most densely populated sections in the state. Within it is located practically all of the cities and metropolitan areas of the south. Its development has been rapid and to meet its ever increasing demands, its water resources have been exploited to the maximum. If growth is to continue and further development in this region take place, the water necessary therefore must come from the Colorado River. This is the only available source. In the passage of the Swing-Johnson Bill congress has made possible the construction of the dam necessary to make the Colorado River water available for use upon the coastal plain. A sufficient quantity of water can be obtained from this source for such use. To make this water available for use on the coastal plain it is necessary that it be transported by means of an aqueduct from a point on the river below the dam. This will require an aqueduct of approximately 225 miles in length and construction of a system of tunnels through the Coast Range Mountains, as well as the construction of two and possibly three gigantic pumping plants to lift the water from the river level to an elevation which will permit it to flow by gravity to a point of use. Such water is only for domestic use and will not be available for irrigation. The cost of such aqueduct and necessary pumping plants has been given careful consideration by the engineering department of the city of Los Angeles, which city has already expended upward of $2,000,000 in surveys and in the study of this problem. The committee is advised, and we are of the opinion, that the procuring of such water from the Colorado River is absolutely essential to the further development of southern California.

THE SANTA ANA RIVER SYSTEM

The Santa Ana River system has its source in the San Bernardino range of mountains. The waters of this system flow through and constitute the source of water supply for the more fertile part of the counties of San Bernardino, Riverside and Orange. This river system has a large and productive water shed reaching from Beaumont to the San Antonio River and extending from the foothills in the San Bernardino Valley to the crest of the San Bernardino range of mountains. The heavy run-off from the higher reaches of this watershed rapidly descends into the valley, swelling the streams, causing them to overflow, flood and destroy valuable property. These floods carry down and deposit on the valley land large quantities of debris and detritus causing additional damage. The turbulent flood waters are heavily impregnated with silt and slickins which, when deposited on the debris cones, prevent the sinking of the water. Protection from these floods and conservation of a part of such storm waters have been carried on locally by volunteer subscription, resulting in only partial relief. The project is of such magnitude and the cost of a proper solution so great that it cannot be borne by those directly interested.

Four years ago this matter was brought to the attention of the state Legislature and action was then taken authorizing the state engineer to cooperate with the interested counties in an effort to work out and submit a feasible plan for economically controlling such floods. Since being so authorized the state engineer, in conjunction with engineers and others representing said counties, has carried on and made an exhaustive study of the rainfall, run-off and storm damages of said river system and the problems therein involved. Such study has been practically completed and the report is or soon will be filed. Such study has demonstrated that there are no available dam sites with sufficient reservoir capacity to make flood control feasible by storage, except, perhaps, the site at Prado, near the boundary between Riverside and Orange counties. A dam at such place would in no wise relieve the upper counties from a continuation of present conditions. However, there are deep and extensive debris cones extending along the entire foothill area of this water shed. These cones are composed of coarse gravel, rocks and boulders. They are very porous and water readily sinks to the deeper strata and percolates into underground channels and subterranean reservoirs. With proper controlled dams and diversion works the run-off from the higher watersheds could be controlled as it enters the valley and be diverted to these cones and sunk through the porous gravel beds into the deeper strata, underground channels and subterranean reservoirs of the valleys. Such diversion would effectively control the floods and incidentally conserve large quantities of water now flowing unused to the sea.

An economic program for the control of this river system should extend over a period of years and should be cooperated in by the interested counties and the state. It has long been the policy of this state, in situations such as this, to cooperate with those directly interested in carrying on work of controlling floods. In pursuance of such policy the state has contributed to the control of the floods of the Sacramento River and the floods of Los Angeles County. Similar treatment should be accorded those interested in the control of the floods of the Santa Ana River system.

MATTER OF STATE CONCERN

When a condition arises in the state in which practically all persons are and all property is directly or indirectly affected, it becomes a matter of interest to the state itself. The state has been fortunate during the past fifty years in that physical conditions have been such that private interests of one kind or another or subdivisions of the state could successfully develop the water resources of the state sufficiently to supply all the needs of the people and to build up unlimited values in property and create vast wealth. It is unfortunate that the time has arrived when present investments are endangered and future developments are about to cease on account of conditions which have arisen from the development of the state up to the present time. This situation exists throughout the highly developed portions of the entire state and is of paramount interest to the state as a whole.

PHYSICAL POSSIBILITIES

The various reports heretofore placed in the hands of the Legislature covering a study of water resources of the state since 1921, are referred to and made a part of this report, although not affixed hereto. These reports were prepared and concurred in by the State Engineer and the following recognized experts: Louis C. Hill, J. B. Lippincott, Wm. Mulholland, A. Kempkey, A. J. Cleary, G. A. Elliott, B. A. Etcheverry, F. C. Hermann, W. L. Huber. These reports are unusually full, clear and carefully prepared, and have definitely answered the question for us from an engineering standpoint. There seems to be comparatively little, if any, difference of opinion in regard to the conclusions reached on egineering matters. It will not be necessary to recite herein data which is there available for your study, except to call attention to such facts as we feel will support our conclusions. Said reports conclude with a recommendation of a coordinated plan for the development of practically all of the state's water resources.

COORDINATED PLAN

It was not intended by that recommendation that any such plan would be completed for many years. It is the thought of the report as well as of this committee that development should not proceed more rapidly than economic needs of the state require, but as it progresses the various uses of water should be coordinated, and the plan suggested in those reports should be so far as practicable recognized and followed.

STREAM REPLENISHMENT

It is well known that the water supply of this state is derived from its annual snow and rainfall which is heaviest in the mountain areas.

"THREE-FOURTHS OF ALL OF THE STATE'S WATERS REACH THE OCEAN WITHIN FORTY-FIVE DAYS AFTER THE TIME OF THEIR PRECIPITATION AS RAIN OR SNOW UPON THE MOUNTAIN AREA." (See page 21, Bulletin No. 12 Department of Public Works, dated 1927.) Again, "The long, warm, almost rainless summers require water in large quantities for all human endeavors, but the summer flow in the streams most valued of all, is only the drain water in wake of the great volume of winter and spring run-off." (Idem. 22.) "Three-fourths of all this water lies within the

northerly third of the state's area, while three-fourths of the need for water lies within the southerly two-thirds of the state's area." (Idem. 22.)

If it is an engineering possibility to construct a dam or dams which will store those flood waters which would otherwise run to the sea within forty-five days, and release them so as to replenish the Sacramento River in summer in excess of its present need for individual development, and by such increased summer flow in the delta push back the salt water, it will again make the great Sacramento Valley safe for development and the delta safe for investment, and also better conditions along the water front.

If it is an engineering possibility to replenish the waters of the San Joaquin River to supply the needs of lands already developed, it will have saved the investments in great agricultural enterprises in that portion of the state. If by a salt water barrier Suisun Bay and the delta can again be made fresh, industry again will be interested in locating there. As economic conditions require, all of the water resources on the western slopes of the Sierra Nevada may be developed as needed. In addition to all previous developments the state may, as its needs require, increase its present developments and its present property values. Cities may grow without limit and without friction. Litigation over water rights will be reduced to a minimum. Irrigation districts and reclamation district bonds and land mortgages and values will be stabilized. Northern and central California will be safe for another long period of intensive development.

The question of engineering practicability has been well answered by the reports of the State Engineer. It has been shown by that study that a dam may be built on the main Sacramento River at Kennett, with a capacity of 2,900,000 acre-feet; that this conservation of flood water would reduce flood flow by one-half at Red Bluff, sustain navigation during the year on the Sacramento River and prevent the encroachment of salt water into the fertile delta to a point near Antioch, and leave a large surplus for the San Joaquin. This reservoir site is ideally located. It has unusually large capacity, with a dam to the moderate height of 420 feet, which capacity could be increased by raising the height of the dam. This dam site is located on an exceptionally firm, igneous formation. Other dams and reservoirs may be constructed, some of which are the Iron Canyon with a capacity of 1,100,000 acre-feet, the Oroville Reservoir on Feather River with a capacity of 345,000 acre-feet; Narrows Reservoir at Yuba, with a capacity of 445,000 acre-feet; Parker Reservoir, with a capacity of 100,000 acre-feet and the Folsom Reservoir on the American River, with a capacity of 307,000 acre-feet. There is no one structure by itself which is more happily located for quantity of storage and safety of construction than Kennett, and there is no other single structure which comes as near answering the present needs of the northern part of the state as does Kennett. It has other economic advantages which will later be considered.

The engineering feasibility of the salt water barrier has been recognized as a part of the coordinated plan mentioned by the State Engineer in his report. It has also been made the subject of a report known as the Walker Young report; also, this matter has been thoroughly presented to the committee by Thomas H. Means in his report on "Salt Water Problems," heretofore mentioned.

Referring to page 48 of Mr. Means' report the summary of Mr. Walker Young's report is favorably quoted as follows: "The summary of Young's report gives his main engineering conclusions as follows:

1. The construction of a salt water barrier is feasible at either San Pablo Point or at one of three sites near the upper end of Carquinez Strait.

2. The barrier can be utilized for both rail and automobile traffic.

3. The cost will depend upon the method of construction. A barrier can be built at Army Point with bridge of 50-foot clearance for $49,600,000; at Benicia for $46,200,000; at Dillion Point for $44,700,000; at Point San Pablo for $75,200,000.

4. The barrier will pass a flood of 750,000 second feet (larger than any flood measured into Suisun Bay) with an estimated raising of water surface of 0.7 of a foot at the barrier, at Army Point, and about 0.55 of a foot at Collinsville. Water levels in the delta under extreme conditions are estimated to be below elevations of high water computed by flood control engineers of the state. With a barrier at Point San Pablo, the raise in water level would be slightly less than at Army Point.

5. The barrier would effectively handle both water transportation through locks and bridge transportation.

6. The barrier would store fresh water and prevent the encroachment of salinity now taking place every summer.

7. The barrier would prevent teredo from working above its location.

8. The barrier can be operated so as not to be a detriment to the fishing industry.

9. The elevation at which water is maintained above the barrier in summer has not been determined. To begin with it should be held a little below ordinary high tide.

The engineers agree that a salt water barrier can be built successfully across Carquinez Strait and provide for navigation and fish regulations; that it will not elevate the level of the water above the barrier to such an extent as to endanger the levees of the delta. The creation of a fresh water lake around the delta as well as around the industrial sites along the water frontage near the great centers of population is of great value and of general benefit. It would also make available for private and public development the excess waters of the Sacramento and San Joaquin rivers. It would also eliminate further litigation between riparian land owners and appropriators.

SAN JOAQUIN VALLEY

The report of the State Engineer is quite complete and convincing that waters from the tidelands may be pumped up the San Joaquin River by a system of dams and pumping plants and levees along the river, and canals extending from Friant on the upper San Joaquin to Kings River and from Kings River south to Erlimart. This system would make available water for replenishing the supply of the San Joaquin Valley.

ECONOMIC QUESTION

The committee is convinced that the projects are feasible from an engineering standpoint, and is convinced also that the water problems of California are critical. Therefore, the more serious and difficult problem of the practicability of these projects from an economic standpoint must be considered.

The original cost estimates for the construction of Kennett Dam, together with the power house, made in the state engineer's report is $80,000,000. One of the most expensive items is the requirement of the removal of that portion of the Southern Pacific railroad which

passes through the reservoir site. In addition, portions of the state highway must be relocated. However, the state engineer and his consultants feel certain that the estimates are liberal in the matter of costs of such changes. Should it be determined that the best interests of the state require the construction of such a dam, it is presumed that the Southern Pacific Company will cooperate in rerouting its line.

The purpose of the Ready report is to show what revenue the state might expect from power at Kennett. It is based upon the original estimate made by the state engineer as to the construction of the dam but changes the estimate of the cost of the power plant by reducing it $10,000,000, thus making the total cost $70,000,000 instead of $80,000,000. This saving of $10,000,000 can be effected by the production of primary power only and the elimination of secondary power which we deem not economically feasible. His estimates are also based upon the operation of the reservoir coordinately for control of salinity to Antioch, control of floods of the Sacramento River to 125,000 second-feet, making available an irrigation supply for the San Joaquin Valley of 330,000 acre-feet per season, or 1000 second-feet maximum rate of flow, and also for the generation of power incidental to the primary uses of the reservoir.

Concerning the marketing of power Mr. Ready, on page 3 of his report, says: "With reasonable cooperation between the state and the existing agencies, absorption of Kennett output will present no serious difficulties. The existing utilities have met problems relatively greater than the absorption of the output of Kennett."

Mr. Ready's study discloses that $64,000,000 of the $70,000,000, together with the interest on said $64,000,000, in all probability could be paid off on forty-year bonds at four and one-half per cent interest, which can be retired by the sale of power at 3.5 mills per k.w.h. at the switch. This revenue would be reduced approximately sixty per cent if the dam were operated entirely for irrigation. Our conclusions are that from an economic standpoint $64,000,000 of the $70,000,000 can be paid off by power in event the water is not released primarily for irrigation. Should power be reserved for pumping water up the San Joaquin River this revenue would be reduced by the extent of the value of the power so used.

Several different locations have been suggested for the salt water barrier. It is estimated that the cost of a barrier at Army Point would be $49,800,000. The cost of the construction of dams, levees and canals for transporting of water up the San Joaquin River is estimated at $24,000,000. Such a construction on the San Joaquin River would have a capacity of 3,000 second-feet, sufficient to supply 450,000 acres of land. The total cost of these three units, to wit: the Kennett Dam, the Salt Water barrier and the San Joaquin pump system and canals would be $144,000,000.

FEDERAL AID

Federal aid in the construction of any of the units herein mentioned may be looked upon as a possibility.

President-elect Herbert Hoover in his address before the Sacramento Chamber of Commerce, June 27, 1925, is quoted as saying: "I speak for myself alone, but I feel we need a reconsideration of the whole basis of the expenditure of the reclamation fund. I would have these

funds used in pouring cement into our canyons and thus storage and more storage. And it should be done under the leadership and responsibility of the state governments. We should by this time know that the federal government has made a ghastly failure as a land speculator. In the long view it can never make a failure in contributing to storage works that will last over a hundred generations.

"We could even find an immediate return from such action for I believe it could be substantiated that the increment in federal income tax alone would finance and more than warrant these outlays. We are all engaged in great effort at tax reduction. But a soundly run business house not only looks after expenditure, it looks to increased revenue. A nation reduces taxes by increasing its wealth and thus spreads the burden. These are reproductive works we are talking about; they are not charity.

"From all of which I am convinced that a marginal contribution to these great works, over and above private and local effort should, if necessary, be borne by the state at large and by the nation at large."

FOOTHILL PROBLEMS OF NORTHERN AND CENTRAL CALIFORNIA

The foothill sections of northern and central California have furnished much of the basic wealth of our state and should not be overlooked in the development of the water resources of those parts of the state. It is important that the state retain such authority over the water coming within its control as will insure a sufficient supply for use within the watershed where such water originates when and as the same may be needed and reasonable provision should be made for maintaining the mountain streams of such territories in the interest of and for the protection of fish and game and for supplying the reasonable demands of outdoor recreation and sports and the demands for all other beneficial uses. Reservation of water for use in this area presents a difficult problem. Economically speaking, lands fartherest from market and from centers of population and land difficult of development are among the last to be brought under cultivation and unless provision is now made for caring for the demands of these lands as well as for the other beneficial uses when and as needed, the right for use for such purposes may be lost. Of the waters brought under control of the state the right of use of such part thereof as may be reasonably anticipated as necessary for supplying and caring for all the aforesaid uses should at this time be reserved, and alloted for such uses as required. In supplying areas of deficiency of water from areas of surplus only such water as is not needed to serve vested or other property rights, or necessary for supplying the uses and purposes hereinbefore mentioned should be considered and no water should be diverted from the area of origin which is now or which may ever be required for any beneficial use within such area of origin.

AMERICAN RIVER WATER SHED

The development of the American River watershed and the storage and controlling of the waters of the American River and its tributaries has been before the Legislature for the past four years. The project has grown in magnitude from the first thought of constructing a dam at Folsom to the present one of constructing at least three dams on the

American River. This project seems at this time to be one which may be undertaken and completed at a comparatively early date by money mostly provided by private companies and on such terms and conditions as will make it operative for flood control from North Sacramento, down stream, for the development of large quantities of power as well as for making some additional water available for domestic and irrigation purposes. The consideration of this now is important, as was demonstrated by the large area of suburban property flooded last March from this river. Data is not available at this time sufficient for this committee to make a definite report on conditions and terms that should be placed in any lease or contract in which the state may enter for the development of this great project; however, we believe it to be to the interest of the entire state that this project should be undertaken at once in substantially the same manner provided in the act passed by the last Legislature and approved May 17, 1927, and reported in chapter 569, page 955, Statutes 1927. We believe that another statute with substantially the same provisions should be reenacted and we have confidence the State Department of Finance will be able to negotiate some contract which will be beneficial to the state and fair to all.

CONCLUSIONS AND RECOMMENDATIONS

First—That the coordinated plan for the development of water resources of California as summarized in Bulletin 12, Summary of "Report of the Water Resources of California and a Coordinated Plan for Their Development," as filed with the Legislature in 1927 by the State Engineer and the Department of Public Works, Division of Engineering and Irrigation, be approved as the plan and policy to be followed by the state, subject, of course, to such modifications and changes as further studies shall demonstrate to be necessary or advisable.

Second—That the state should construct, own and operate Kennett Dam with a view to the conservation and most beneficial use of the surplus waters of the Sacramento River along lines favorably affecting flood control, salinity control, navigation and irrigation, and that the state should construct and own a power house at this dam and reserve to itself full authority to operate both dam and power house for the primary purpose of regulation and use of water for the aforesaid purposes and for the secondary purpose of hydro-electric power development. The power should be sold at the switch on contract to be made with the highest bidder before construction of the dam and power house is begun, said contract to run a reasonable length of time from date of delivery of first energy; said contract also to provide for allotment to the state at sale price, plus actual transmission costs, so much of the power as will be required for the San Joaquin Valley pump system and any or all other projects requiring electrical energy that may hereafter be built by the state in connection with the development of its water resources.

Kennett Dam should be constructed, as recommended by the State Engineer, to the height of 420 feet, but on a foundation calculated to support an additional 120 feet.

Third—That the construction of a salt water barrier at or near Army Point at a cost of approximately $50,000,000 is necessary for a complete carrying out of the coordinated plan for the development of the water resources of California as recommended in the first paragraph of these recommendations.

Fourth—That the construction of dams, pumping plants, aqueducts, and levees for the purpose of pumping and transporting water from the Sacramento River to and for use in the San Joaquin Valley at a cost of approximately $24,000,000, is necessary for the complete carrying out of the coordinated plans for the development of the water resources of California as recommended in the first paragraph of these recommendations.

Fifth—The question as to whether bonds for the construction of said salt water barrier and the dams, pumping plants and aqueducts for the San Joaquin Valley referred to in paragraphs three and four of these recommendations be voted at the same time as the bonds for the construction of the Kennett Dam is being held in abeyance by the committee for further consideration.

Sixth—In southern California 80 per cent of the water supply is now being drawn from wells and all available stream flow utilized. The ground water levels are being lowered by overdraft. The population increased from 1910-1920 85 per cent, and this ratio is continuing. The only adequate relief must come from the Colorado River. The building of the Boulder Canyon Dam has been provided for by congressional appropriation. There remains the construction of the aqueduct, the cost of which may be $150,000,000. This water is to be used by the cities of the south for domestic purposes. Eleven towns are now organizing for this purpose. The cost of carrying out the plan will be very burdensome. Besides this condition, there is the very serious situation as to water supply in Imperial and Coachella valleys and possibly other parts of the state along the lower Colorado River. If a comprehensive state project is adopted some provision should be made to extend assistance to these municipalities and agricultural areas in southern California. The ways and means for so doing can not now be definitely stated. They will be given further consideration in conference with representatives of that section during the next 30 days.

Seventh—That the financial cooperation of the United States government should be given in this undertaking, that steps should be taken by the state at once to acquaint the federal government with this proposed development, that the proper state officials be authorized to enter into negotiations with the federal government to that end, but that there be no delay in either the submission of the bond issue or actual construction of the proposed works pending such time as final decision is made by the government as to whether it shall aid California as requested.

Eighth—That the state give such assistance toward the control of flood waters of the Santa Ana River as may be necessary and consistent with the policy as applied to the Sacramento River and the Los Angeles flood control.

Ninth—That the state renew and continue its water filings on such streams as may, in the judgment of the state engineer be needed now or hereafter for the purpose of carrying into effect the flood control or other policies contemplated in the coordinated plan, provided, however, that such filings should be released if and when such waters are needed for developments undertaken by others than the state itself of projects in harmony with the coordinated plan.

In conclusion your committee desires to state that it has avoided all reference to ways and means of financing the above recommended projects and to announce that during the constitutional recess it will conduct public hearings in San Francisco and Los Angeles to receive suggestions from all interested as to this phase of the undertaking, other questions held in abeyance. In the deliberations of this committee we have considered at least two possible methods of financing, one by a statewide bond and the other by district assessments according to benefits. We are open minded on both of these, and any other possible plans that may be suggested.

Shortly after this Legislature reconvenes for the second session we will submit a supplemental report, with our recommendations as to how this development is to be financed.

Signed:

B. S. Crittenden, Chairman.
E. G. Adams, Secretary.
Ralph E. Swing, Vice Chairman.
H. C. Nelson.
Will R. Sharkey.
Van Bernard.
Frank W. Mixter.
Edwin A. Mueller.

EXHIBIT "A"

REPORT OF LEGAL COMMITTEE TO JOINT LEGISLATIVE COMMITTEE APPOINTED TO INVESTIGATE THE WATER PROBLEMS OF THE STATE AND TO RECOMMEND SOME STATE-WIDE POLICY FOR THE CONSERVATION AND USE OF WATER.

EXHIBIT "A"

Report of Legal Committee to Joint Legislative Committee Appointed to Investigate the Water Problems of the State and to Recommend Some State-wide Policy for the Conservation and Use of Water.

To the Joint Legislative Committee appointed to investigate the water problems of the state and to recommend some statewide policy for the conservation and use of water.

GENTLEMEN:

The committee of attorneys appointed by your chairman to advise you with regard to legal questions arising in connection with your investigations and in the preparation of your report has made a study of the state of the law with respect to the matters within the scope of your investigation, and now submits a statement of its conclusions.

Assembly Concurrent Resolution No. 30, in pursuance of which you are proceeding, declares that the purpose of your appointment is "to make an investigation of the water problems of the state and to recommend to the Legislature of the State of California at the forty-eighth session thereof some statewide policy for the conservation and use of the waters of the state."

It is apparent from this language that the problem before you, in the solution of which you have asked our counsel on legal questions, is, stated in a broad way, how the most extensive practicable use may be made of the waters of the state, and it is equally obvious that this involves radical interference with the natural flow of our streams and underground waters, both by the diversion and distribution of these waters in ways widely at variance with the course of nature, and, also, by arresting the flow of water by impounding it in storage reservoirs and releasing it for various uses at times widely different from the times when it was wont to flow.

The fundamental water law of the state is the riparian right, but it is recognized that the water resources of the state are sufficient to irrigate large areas of land in addition to the lands riparian to our streams. In order to irrigate this additional area, it may not be necessary to take from riparian owners the quantity of water needed for the economical irrigation of riparian land, but, obviously, the water in excess of the amount required for economical irrigation of riparian lands can not be taken if the riparian owner is to enjoy the full flow of the stream, and the question, therefore, presents itself at the threshold of the problem as to how the state may make this broader use of the water consistently with private rights.

JUDICIAL DECISION

The Legislature in 1850 adopted the common law of England in its entirety, except so far as it was contrary to the constitution and statutes of the state. In doing so, it did not even embody the clause embodied in like laws of other states limiting such adoption of the common law in so far as it was applicable to conditions in the state. It has been suggested that the adoption of the common law, together with the riparian doctrine which was part of it, was accomplished by the Legislature after careful consideration of the subject. So far as we have been able

to ascertain, there is no evidence that the Legislature realized or discussed the fact that it was adopting the riparian doctrine of water rights. After this enactment in 1850 the Legislature passed practically no law making any definition whatever of water rights until the adoption of the codes in 1872. When the codes were adopted, they codified the customary law regarding appropriations of water, but were careful to add: "The rights of riparian proprietors are not affected by the provisions of this title." Certainly, no criticism could be made of a court arriving at the conclusion that the Legislature had intended not only to recognize, but thereby to protect riparian rights. The Legislature passed no other law on the subject until 1887, when it repealed this provision, but in the repealing act expressly provided that "the repeal of this section shall not in any way interfere with any rights already vested." Again, the courts could hardly be criticised for holding that this was intended to protect all riparian rights which had vested at that time.

The courts, therefore, being unaided by the Legislature and all of the meager legislation on the subject indicating that riparian rights did exist in the state, could hardly be seriously criticised for so deciding. They felt that it would be in the nature of legislation to hold that the riparian doctrine could only be deemed to have become the law of the state so far as applicable to our conditions, which require the use of all of the waters of the state on arid lands, and that, therefore, the right was limited to the quantity of water reasonably required when economically applied. The courts, having pronounced the contrary rule respecting these property rights, it is too much to expect that at this day the courts would reverse that ruling. This, however, does not prevent the courts from deciding as original propositions any particular features of the riparian right not decided in previous cases. But, as a general proposition, the general right and its incidents must be deemed to have become so fixed that they are not likely to be changed by mere judicial decision.

FLOOD AND FRESHET WATERS

It has been frequently suggested that the difficulty could be avoided by holding that riparian rights do not extend to what are sometimes called "flood" or "freshet" waters. These terms are frequently used with various meanings, but, in their broadest significance, they usually mean waters which the streams are not able to hold within their banks, but which, either on account of heavy rains or melting snows, so swell the stream that large areas of land are overflowed and inundated. These terms are so occasionally used with reference to extraordinary and irregularly occurring flows through ordinarily dry washes, or flows which are otherwise unforseeable or undependable, even though held within the banks. Some support has been given by decisions of the courts of this state to this contention, but the only cases which can now be thought to represent the present view of the courts in which this doctrine has been given any effect is in regard to water of streams in which extraordinary freshets are sometimes caused by excessive and unexpected rainfall. Such water has been held to be no part of the water to which the riparian owner is entitled. On the other hand, the Supreme Court has quite definitely held that with respect to the great

rivers of the state, which are affected primarily by the melting snow, the floods caused by such melting regularly occur, and can be foreseen, and are expected, and, therefore, are part of the regular flow of the stream to which riparian owners are entitled. Even, therefore, if a person deemed it economically feasible to reservoir the waters of the extraordinary and unforseen freshets and it was held that this might legally be done, it would not solve the problem which we have before us, which has to do with the great rivers of the state, which are filled primarily by the melting snow, and with respect to which it has been held that the floods caused thereby are subject to riparian rights. Both the melting of the snow and the ordinary rainfall can be foreseen, and the floods which result are not extraordinary, but, under the decisions, would seem to constitute a part of the regular flow of the stream to which the riparian owner is entitled. The result is, that while in individual cases it might be that a decision might be obtained with respect to a particular stream that certain of its waters were flood or freshet waters not subject to riparian rights, as a general proposition such does not seem to be the situation, and, since we are dealing primarily with streams of a different character, it would seem that this doctrine can not be considered as offering any satisfactory solution of the problem before us. However, as a practical matter, it will be found that where most of the land along a stream is reclaimed and the maintenance of levees becomes important, there will be less likelihood of objections to the storage and diversion of waters that would menace the works of reclamation.

In some portions of the state, particularly the semiarid regions, problems of flood and freshet waters are no doubt of considerable importance in connection with flood control and water spreading projects, but detailed consideration of these matters would seem to be out of place in a general report dealing primarily with the major streams of the state.

DEDICATION TO PUBLIC USE AND PRESCRIPTION

There is no doubt that where water has been taken from a stream and used for five years adversely to the lower riparian owners a prescriptive title to the water thus taken is obtained as against them. It is also established that, in case water is taken for a shorter period and applied to a public use with the knowledge and apparent acquiescence of the riparian owners and the rights of the public have intervened, the continuance of the use cannot be stopped, but it may continue, subject to the payment of compensation if demanded within the statutory period.

As a practical proposition, these doctrines have operated to avoid the claims of riparian owners on a great many streams, for it is a well known fact that huge irrigation developments, as well as water power developments, have been successfully carried out both by public, *quasi*-public and private interests, without any objection whatever from riparian owners who might have claimed the right to the full flow of the stream. Generally speaking it seems to be the fact that where these developments do not deprive persons of water which they actually need for beneficial purposes, they make no objection to such developments. However, our present investigation is being conducted on the

theory that objection may arise to any project of the state, as it has in individual cases arisen with respect to other projects, and we must advise as to the best way to obviate such objection, if made.

It is proper to state that claimants of the right to appropriate for use on nonriparian lands water that is not needed on riparian lands point, in justification of their claims, to the establishment of the custom of appropriation by the miners and to the recognition of the doctrine of appropriation in the Civil Code by the Legislature in 1872. They insist that the provision, inserted when the codes were adopted, that the rights of riparian owners should not be affected by the sections providing for the filing of notices of appropriation, was intended to preserve to the riparian owners only the right to so much water as they might actually need, and in support of this they emphasize the fact that in 1887, at the next session of the Legislature after the final disposition of the case of *Lux* vs. *Haggin* in 1886, the Legislature repealed this saving provision. Furthermore, they direct attention to the fact that in 1913, the Legislature passed the Water Commission Act, which was approved by the people on referendum in 1914, and by this act all water not appropriated or reasonably needed for use on riparian lands was declared to be subject to appropriation, and rules for obtaining permits and licenses for the appropriation of water were established.

POLICE POWER

Naturally, one of the suggestions which occur in this respect is that in some manner the desired result could be accomplished by the exercise of the police power. In connection with this, it should be noted that the courts, in deciding riparian rights as between individuals, have not generally been called upon to pass upon the right of the state in case it asserted it under the police power. The courts have had occasion to refer to certain acts of the Legislature which merely undertook to permit private persons to appropriate and take water away from the riparian owners on the theory that the state had a proprietary interest in the water, and to hold that this could not constitutionally be done.

The courts have passed upon certain acts passed under the police power, such as acts to prevent the waste of water, and held them constitutional, and the act limiting land to a definite quantity of water, and held it unconstitutional, but the courts have never deemed that they have been called upon to pass in a broad way upon the question as to the power of the Legislature to deal with or regulate riparian rights for the public good, under what is generally known as the police power.

Specifically, therefore, the question presented is whether the Legislature under the police power could limit the right of a riparian owner to such water as he requires when economically diverted and applied, and whether, if it could do so, that would prevent the riparian owner from objecting to a diversion which deprived him of the right to the full flow, but did not deprive him of the amount economically required. This question presents the broadest field for philosophical discussion. The leading cases by the supreme court of the United States involving the police power are, in fact, philosophical discussions, and the conclusions arrived at, even by a four to five decision, are controlled

by the peculiar philosophy of the individual justices pronouncing the conclusion of the court and the consequent dissenting opinions. Many generalizations have been attempted in regard to the police power, but it will be found that almost all of them break down when put to the test of judicial decision. It has frequently, for instance, been said that there is a clear and marked distinction between the regulation of property under the police power and the taking of property under the power of eminent domain, but under the latest pronouncements of the supreme court of the United States, there is no such clear demarcation. On the contrary, it has recently been pointed out that when the Legislature forbids a man from erecting more than a five-story building on his property, it does, to the extent that it forbids the use of his property, take it from him. Still, in a proper case, this may be fully justified under the police power without compensation.

It, of course, is deemed that the very nature of water makes it peculiarly a subject of the exercise of the police power. There can not be much serious question that the Legislature has full power to require such economy in the use of water as is necessary, at all events, in order that all those entitled to use the water may enjoy it. But, whether it can make like regulations for the purpose of making a more extended use of the water by a general plan for the conservation and use of the waters of the state in the interest of the public presents a different question. We believe, that in view of the latest decision of the Supreme Court of California that it did not intend to prejudice the question as to the rights of the state under the police power, this committee should not assume that the Legislature could not so provide by the exercise of that power. On the other hand, we believe that it would be an unfounded assumption of knowledge for this committee to presume to decide that the Legislature could under the police power solve the problem before us, in view of the absence of any controlling decision on the question. We know that the Legislature could not, by the exercise of the police power, take away from the riparian owners waters which they reasonably require for their needs when reasonably and economically applied, and, we presume, it would be equally recognized that from the standpoint of fairness and justice the Legislature would not desire to do so if it could. Whether it could limit, so to speak, the riparian owners to a quantity of water economically needed by them, is a question which should not be foreclosed by us, nor should we attempt to advise that the Legislature has or has not such power. If the state should determine to attempt such a regulation of riparian rights, there is adequate machinery in the law for the determination of its validity.

NAVIGABLE WATERS

The principal rivers of the state, the waters of which the state desires to take for public use, are navigable streams. In the decisions of the courts regarding water rights between private individuals, the courts have had little or no occasion to consider the nature of the rights of the state in navigable waters. The suggestion has been made that the state has a right to use the navigable waters of the state either for navigation or other public uses, and that any rights of riparian owners must be held subject to the superior right of the state. The far-reaching effect of this contention can readily be seen.

Assuming that the state had any such power, it is inconceivable that it would desire to exercise it so as to interfere in any way with the navigation interests of the state or the enjoyment by riparian owners of the waters of streams, so far as the same are reasonably necessary for their lands. It is equally inconceivable that it would desire to exercise it so as in any way to question the right of appropriators to continue to enjoy waters appropriated by them and reasonably needed for the purposes for which the appropriation was made. Whether it might desire to exercise the right as against the claim of a riparian owner to the full flow of the stream, although such flow is not reasonably necessary for his use, presents a question of public policy on which this committee could not well pass. The attitude, however, of the Legislature on Assembly Constitutional Amendment No. 27, submitted to the people by the Legislature at its last session, might be construed as indicating that it did not have a high regard for this claim.

Here, again, we have no authoritative decision by the courts of this state on the subject. Examining the decisions of the courts of other states, we find, first, that the courts of some states have held that the state is the owner of all navigable waters and is entitled to take them in aid of navigation or for any other public use, and that the rights of riparian owners are entirely subordinate to the right of the state; second, in other states the courts have held that the state only owns the navigable waters for the purpose of navigation, and that it can not take, or authorize the taking of, the water for other public purposes as against riparian owners; third, it is held that whether or not the state may take the water as against the claims of riparian owners, depends on the question whether the state or the riparian owner owns the bed of the navigable streams; and fourth, in many states it is held that even where the state owns the navigable waters for all public purposes, it may grant rights therein which would become superior to any right of the state, and the question as to whether such rights have been granted, of course, involves many considerations of law and fact.

In attempting to apply these decisions to this state, we find many difficulties. By section 670 of the Civil Code it is provided that the state is the owner of all land below tide water and below ordinary high-water mark bordering upon tide water within the state; and of all land below the water of a navigable lake or stream. By section 830 of the same code it is provided that a grant of land bordering on tide water extends to *high*-water mark, while a deed to land bordering on a non-tidal navigable lake or stream extends to *low*-water mark. Whether the effect of this would be to limit the title of the *state* in the bed of a navigable lake or stream to the land below *low*-water mark, does not appear to have been decided, and a decision on that point might materially affect its title to the *water* of non-tidal streams above the low-water mark.

We find that, as between private individuals, our courts have recognized the rights of riparian owners on navigable streams, but have had no occasion to determine whether such rights are subordinate to the superior rights of the state for purposes other than navigation. In view, therefore, of the fact that the courts of different states have come to different conclusions on this subject, we do not believe that it would be of any benefit for this committee to attempt to express an opinion

on this very important question. All that we can say is that the contention does exist, and it can not be said to be without merit, nor can it be, with any degree of certainty, said to be well founded.

There is also some doubt as to how far a decision in favor of the state on this question would solve the present difficulty. The decisions in other states seem very generally to hold that even where the state has a right to use the waters of navigable streams for any public purpose as against the claims of riparian owners, the state can not do so to the injury of riparian owners on non-navigable portions of the stream, or upon non-navigable branches or tributaries. Undoubtedly in certain cases the riparian owners claiming the right to the full flow of the stream would own land upon non-navigable branches of the river, and it might be those very branches that were most affected by the taking of the water.

For these reasons, we feel that no definite opinion can be expressed as to the right of the state in this particular, or how far a decision favorable to it would solve the difficulty in any particular case.

EMINENT DOMAIN AND COMPENSATION

Of course, it is elementary that the state, under its inherent power of eminent domain, has a right to take water for public use, just as it has the right to take any private property in condemnation proceedings, subject to the constitutional requirement that just compensation be paid for the property taken. So that, in all events, the state has in its hands one method by which it can effectively remove the obstacle which we have been considering.

This principle is so elementary that it is needless to enlarge upon it, and the only suggestions which this committee could make would be with regard to the procedure by which riparian rights might be condemned and compensation fixed. In this regard three distinct procedures have been considered, as follows:

First, the present statutory method of a proceeding in the superior court, in which the judge decides all questions except the amount of compensation, which is fixed by a jury, unless a jury is waived by the parties. This procedure, of course, has the advantage of being the procedure in vogue, and it also has the advantage that it would only be invoked when and if a riparian owner insisted on his right to the full flow of the stream. Under this procedure, as well as under the others hereinafter considered, the court can decide all conflicting claims of the parties with regard to the water of the stream, as well as the compensation to be paid for the rights taken, subject, of course, to the right of appeal. If there should be any doubt on this latter point, a simple amendment of the Code of Civil Procedure could confer power upon the court, in any eminent domain proceeding, in which there was doubt as to the title of the property to be condemned, to determine first the relative rights of the parties in and to the property and then to fix the amount of compensation to be paid for the property necessary to be taken for public use.

There is now a statute which provides that the court may appoint competent persons for the purpose of investigating without prejudice to either party the facts of the case and reporting to the court their conclusions, subject, of course, to cross-examination by the litigants and to

the right of the litigants to produce witnesses in their own behalf. There is a provision in the State Water Commission Act whereby the court may refer to the State Water Commission (now the Division of Water Rights) as referee litigation affecting water rights. The Division of Water Rights and the Division of Engineering and Irrigation are both equipped to gather data that would be useful in an eminent domain proceeding of the character under consideration, and one or the other of these divisions might be made available by law for the assistance of the courts in such cases.

Second, it has been suggested that an administrative proceeding be provided for by act of the Legislature whereby some administrative tribunal would inquire into the damage which would result to riparian owners by the taking of water for public use and that the findings of such administrative body should be subject to recourse in the courts, in which they would be *prima facie* evidence as to the amount of damages. Some have suggested that the present Division of Water Rights could act as such administrative tribunal, while others have urged that this division is too closely connected with the program of the state in the working out of a comprehensive program for the conservation and use of our water resources to be deemed an impartial tribunal. Consequently it has been suggested that a new commission be created for this particular purpose or the State Water Commission be revived as an independent branch of the state government.

In this connection it has been suggested that in connection with the appropriation of water the Division of Water Rights could be given authority to hear any protest on the ground that such appropriation would damage riparian land, and determine, in an administrative way, the extent of such damage, leaving the parties the right to judicial recourse with a jury trial if the administrative award should not be accepted.

Those who advocate such an administrative tribunal argue that the results of its work would be much like those of a board of viewers in the laying out of a public road, and that in the great majority of cases the award made by the tribunal would be accepted without question, and that if in some cases an award was not satisfactory and the matter was taken into court, the work done before the administrative tribunal would all be available in the trial before the court. It is pointed out that the Water Commission Act now provides for a somewhat similar procedure in stream adjudications, and that similar provisions are found in the statutes of other states, and that the history of such proceedings is that the administrative determination is accepted in a vast majority of cases.

On the other hand, it is obvious that if the award of the administrative tribunal is not satisfactory, it will be necessary for the land owner to incur the expense and trouble of an additional proceeding in court in order to obtain what he considers to be his rights.

Third, neither of the two foregoing procedures would require any modification of the constitution. It has also been suggested that a constitutional amendment be prepared for the establishment of a judicial tribunal to determine conflicting claims to water rights and the compensation to be paid in case of the condemnation of such rights, such tribunal to function as in the case of the State Railroad Commission and the Industrial Accident Commission, when exercising judicial

functions. It is pointed out that the determination of such a tribunal as to matters of fact could be made conclusive, and its decisions subject to review only by the appellate courts on questions of law.

It is obvious that much can be said in favor of and against each of these proposals. They involve largely a question of policy, and partiality for one or the other depends largely upon the point of view of the individual. It is hardly within the purview of the duties of this committee to express any preference on the subject.

In determining, however, which, if any, of these suggestions adequately meets the situation, this controlling feature should not be overlooked, namely, that as a general rule the state does not desire to condemn all of the rights of riparian owners, but that in most cases it will be desired to leave to the riparian owners the quantity of water which they reasonably require for economical use. One great difficulty in any condemnation proceeding, whether strictly judicial or administrative, is in devising a procedure which will take away from the riparian owner only that excess of water which is desired to be taken. In the ordinary proceeding in condemnation, the plaintiff states what water he wishes to take, and the question is to what extent will that damage the riparian owner. The difficulty is that it is impracticable in such a proceeding to ascertain whether such a taking will only deprive the riparian owner of the excessive quantity of water which he really does not need or whether it will deprive him of water which he requires for his uses. This will readily be seen when we consider that the right of a riparian owner on one of our great rivers is entirely correlative with the rights of many other riparian owners, and unless there is sufficient water left in the stream after the condemnation to supply the reasonable needs of all riparian owners on the stream, the defendant in the condemnation suit may be deprived, as a result of the proceeding, of water which he absolutely requires for his needs. Thus, if a stream is flowing 10,000 second-feet, the taking of 500 second-feet might not injure, or even inconvenience any riparian owner, but if the flow of the stream drops to 1,000 second-feet, the condemnation of 500 second-feet might result in serious loss to a riparian owner who would have to share the remaining 500 second-feet with a large number of other riparian owners. The effect of the taking of any given amount of water from a stream can best be determined by an investigation of the entire stream and the needs of all parties upon it. Such an investigation in each individual condemnation proceeding would be impracticable, unduly expensive and place a burden upon the parties that would be unbearable, and this would be true, whether the proceeding was before the court or before an administrative body. Whatever procedure, therefore, is adopted, it should be adequate in some way to ascertain the amount of water which the riparian owner does require and in some way assure him of that quantity, and then, if necessary, condemn the right to take the surplus as against the legal right to the full flow of the stream. Of course the right of the state, if necessary, to condemn the entire riparian right, would remain as at present, and, undoubtedly, in some cases the condemnation of the entire right would be necessary, but, generally speaking, it would not be necessary or desirable.

The suggestion has been made that the damages which the riparian owner claiming the full flow of the stream would recover would generally be small. This entirely overlooks the difficulty which has just been pointed out. If the trier of the facts, whether it be a jury or an administrative tribunal, is left in doubt as to whether the condemnation will leave the riparian owner with a clear right to a sufficient quantity of water for his reasonable economical uses, the damages awarded must, in the nature of things, be large, and not small. If, therefore, justice is to be done to the riparian owner and at the same time to the public in its desire to take the surplus water, some procedure must be devised which will assure to the riparian owner water for his reasonable needs and limit his damages to such amount, if any, as will compensate him for any loss he may sustain by the appropriation of the surplus.

It has been suggested that this difficulty may be met by the condemnation of the entire riparian right of the defendant, with a guarantee by the condemning party, in lieu thereof, of a certain definite supply of water, to be taken from the appropriation of the condemning party. This would put upon the condemning party the duty to protect the appropriation, both for itself and for the riparian owners whose rights were condemned, against any demands of other riparian owners on the stream who were not parties to the condemnation proceedings; and on the other hand, it would give the riparian owner a definite supply of water, which could be determined by the court to be sufficient for the needs of the riparian land.

It has also been suggested that provision be made for a proceeding *in rem* in the superior court or one of the other tribunals hereinbefore suggested, to settle and determine all rights in a particular stream, with a provision that each riparian owner might, in lieu of his riparian rights, accept a certain quantity of water with a priority over all persons except those who had already acquired better rights against him. In case any riparian owner refused to do this, his riparian rights over and above such quantity of water as might be found to be necessary on his land would be valued and condemned in such proceeding, and their value paid to him, and then all the rights on the stream would be fixed in the final judgment in the proceeding. The result would be an assurance to the riparian owners of enough water for their land, and no more, and an assurance that the balance of the water would be available for other purposes, and finally at the same time the rights of all persons in the stream would be settled, and the stream would be in a condition to have the water actually measured and delivered to those entitled to it under the direction of a water-master, if that were found necessary.

A proceeding of this nature is now provided for in the Water Commission Act, but it is limited to rights by appropriation and there is no provision for determining the rights of riparian owners in that proceeding, or for condemning rights of any character.

No matter what course of procedure may be followed, the committee recommends that consideration be given to the following proposals for changes in the law of eminent domain:

First. One suggestion is that, unless a tribunal having state-wide jurisdiction is provided for, the law should be changed to allow a condemnation proceeding to be brought in the county in which any part

of the riparian land is situated. At present, a separate suit must be brought against owners in different counties, whereas the effect on these lands should be determined in the same proceeding. This suggestion is not based merely on considerations of convenience, but is made in view of the fact that many streams flow through more than one county and that for reasons hereinbefore pointed out it may, in many cases, be essential that the correlative rights of all riparian owners and appropriators on a stream be ascertained in the same proceeding.

Second. The constitution originally provided that private property should not be taken until compensation was first made and paid, and this was held to prohibit the Legislature from providing that the public might take possession upon giving security for damages. This resulted in amendments providing that in any action of eminent domain brought by the state or a county, or a municipal corporation, or a drainage, irrigation, levee or reclamation district, the aforesaid state or political subdivision thereof, or district, may take possession and use of any right of way upon giving security for damages. It will be noticed that the amendment does not include all public districts or public utilities, nor does it include quasi-public corporations, and the words "right of way" are quite indefinite. We see no reason why this section should not be again amended so as to generally permit possession of any property to be taken by anybody exercising the right of eminent domain upon making deposit for the owner. At all events, it should be amended so as to include water.

Third. Another change in the law of eminent domain which might be of great importance, but which should receive critical study before it is put in definite form, would be the adoption of Legislation or constitutional amendment providing for compensation by substitution based on the recognition of the fact that compensation wholly in money does not always adequately meet the situation, and that physical adjustments are often required by the facts of a particular case. For example, the construction of a reservior may flood a private road essential to the use of nearby lands, and if the proceedings for the condemnation of the private road must, as at present, take the form of fixing the compensation for what is taken, the award may have to be a very large one. The utility constructing the reservoir may, however, be perfectly willing to, and could at far less expense, provide a private road across the dam which creates the reservoir, which would be equally as good as, or even better than, the existing road, and thereby completely eliminate the damages resulting from the destruction of the road, but there is no way, under the present law, in which the utility could compel the owner of the private road to accept the new road in lieu of cash compensation based on the destruction of the old, nor, on the other hand, can the owner of the road insist that the utility give him the right of way across its dam.

Another illustration may be found in the case of a power company desiring to divert the flow of a stream above a point where an irrigator diverts say, 100 inches of water into a ditch for irrigating his land. The power company may be perfectly willing to construct a pipe or ditch from its conduit, which will deliver to the lands of the irrigator

the full 100 inches to which he is entitled, and may be able to construct the necessary works at a cost of say $1,000. Under the present procedure, however, the land owner could insist on compensation for the taking of his entire water right and might be legally entitled to say $100,000 damages.

Cases of this kind are often adjusted by mutual agreement. Serious consideration might well be given to the question of the possibility of making changes in the law which would permit a plan for compensation by substitution of physical adjustment to be suggested by the parties to an eminent domain proceeding, and if found by the court to be compatible with the greatest public good and the least private injury, and to afford just compensation, to be carried into effect by judgment, either with or without monetary compensation.

Some steps in the direction mentioned have already been taken by the inclusion in the Code of Civil Procedure of provisions for the relocation of structures or improvements and the making of crossings and the construction of fences; but although they seem to recognize the principle of physical adjustments they are far from adequate to meet the exigencies which may arise in connection with any state-wide plan.

Fourth. Another subject requiring detailed and careful consideration is found in the fact that the present statutory provisions on the subject of eminent domain contain many illogical and impracticable provisions. Numerous amendments to meet specific cases have been adopted from time to time until the portion of the code relating to eminent domain has become not only illogical but even self-contradictory. There has been no systematic revision of these provisions since 1872. Other states, notably New York, have, in recent years, adopted revised statutes on the subject of eminent domain to meet present day conditions. The subject is, of course, much broader than the subject matter of this committee's activities, but it is obvious that the adoption of any state-wide plan with reference to waters must involve extensive resort to the powers of eminent domain, and the consummation of any such plan might be seriously hampered by the inadequacy of the present law and the absurdities it contains.

Fifth. In several of the western states the Legislature has declared irrigation to be so essential to the well being of the state as to constitute a public use, whether the use is for the general benefit of the public or for the private benefit of the irrigator. The validity of such legislation has been very generally upheld by the courts, including the Supreme Court of the United States, and if such a law were enacted in California it would enable any appropriator to take advantage of any statutes which the Legislature might pass for the condemnation of riparian rights in order to permit the irrigation of nonriparian lands. There seems to the committee to be no objection to such legislation, and that considerable advantages might flow therefrom.

HYDRAULIC POWER OF STREAM

There are several circumstances under which the hydraulic force of the stream as a valuable right might be claimed by the riparian owner, and we will therefore consider them separately.

1. *Production of power.* The right of the riparian owner to use the stream for the production of power is a well established one. In

early days the power of the stream was directly applied to the operation of machinery, but under present conditions that method is but little used. The modern method is the use of the stream for the production of hydro-electric power. So far as the valley lands are concerned, the use of the streams for this purpose may for practical purposes be disregarded. Abstractly, the owner of a piece of riparian land near the mouth of one of our great rivers is entitled to the full flow of the stream for the propelling of machinery. But the stream is of little value for that purpose, is practically never utilized for that purpose and could not economically be maintained for such purpose. On the other hand, in the mountain regions the production of power is the important factor.

In those cases where the natural flow of the stream is used for generating power and the water is returned to the stream above the irrigated areas, the power use does not conflict with the irrigation use. In many cases, however, the economical utilization of the stream for generating power requires the use of large reservoirs, to store the summer flood flows for use at other seasons of the year, and particularly in the winter when in general the maximum power demand occurs. On the other hand, the maximum demand for water irrigation in general is in the early summer months. A conflict thus arises in many cases between power uses and irrigation uses. In such cases the manner in which the conflicting interests can be reconciled must of necessity be determined in the light of the particular facts of each case. Occasionally it is practicable to construct reregulating reservoirs below the power works and reestablish the natural flow, or even to create a condition more favorable to the irrigators than the natural flow. In other cases the rights must be adjusted by amicable agreement or resort to the power of eminent domain.

2. *Use of hydraulic forces as a means of diversion.* In a state of nature the hydraulic force of the full flow of the stream undoubtedly at times either directly diverts water by way of overflow onto the adjoining land, or indirectly does so by raising it into high-water channels and thence over the land. Obviously, this condition can not ultimately be maintained. At the same time the owners of land benefited thereby will naturally oppose any deprivation thereof. Undoubtedly in certain cases this could be avoided by the construction of proper means of artificially diverting the water. Whether that could be accomplished under the police power or whether the party desiring to take the water would be compelled to furnish such appliances is a matter comprehended in the general question of the extent of the police power, which we are not attempting to pass upon. However, if the right to construct such appliances, if necessary by means of the power of eminent domain, were granted, the situation could be satisfactorily handled. The question whether in any given case it would be better to condemn the overflow right entirely or substitute for it a more up-to-date method of irrigation would be a question of economies in any given case.

3. *Use of hydraulic power to force water into underground channels.* There are cases where the high flow of the stream forces water into underground channels or permeable strata from which the water is later abstracted by means of pumps for irrigation. The best illustration of

this situation is the Coyote Creek in Santa Clara County. Such a use of the water is of course of substantial value. Economically such areas could not well be deprived of the quantity of water naturally coming to the land. The water, however, which serves this hydraulic purpose, and then flows to the sea, never reaches the land, and if the construction of artificial structures would cause the same quantity of water to naturally flow to the land, and at the same time conserve the surplus which would otherwise be lost, there would seem to be no substantial objection to such a procedure. We understand that some such solution was applied to a like situation on Alameda Creek. At all events, the situation does not seem to be one that could not be solved in most cases in some manner so as to preserve the water which under natural conditions is lost.

4. *Use of hydraulic force to protect land from encroachment of salt water.* This situation presents itself on the delta of the Sacramento and San Joaquin rivers. There is some dispute as to whether or not lands thus situated have riparian rights. There is also some dispute as to whether the use of the water for the purpose mentioned is a riparian right. Without attempting to pass on those disputed questions, there is no doubt that from an economical standpoint the lands should be assured of the reasonable quantity of water needed for irrigation. The exact method by which the saline situation might best be handled is one upon which many persons are now working who are probably better advised than we are as to the physical situation. Of course the construction of some artificial barrier against the salt water is the method that naturally first suggests itself, and that is being seriously considered by both the state and federal governments. Others have suggested that it would be feasible to supply to these lands a sufficient quantity of water to hold back the salt water. Of course this would result in some loss of water, and the question would simply present itself as an economic one whether that were cheaper than building a barrier to keep the salt water out. The problem is a large one, and whether the owners of these lands are entitled to insist that anyone taking the surplus water must protect them, or whether they must protect themselves against the salt water, presents legal problems which are difficult of solution and which will probably disappear in view of the economic problems involved. In other words, as a practical proposition, the state may not find it advisable to permit damage to such lands in order to permit the irrigation of additional areas. At all events, the quantity of water needed to protect those lands could be ascertained and determined, and become a limiting factor in determining the surplus available for diversion and use.

CONCLUSION

In this report we have assumed that any proposed legislation concerning the conservation and use of water would recognize, frankly and fairly, all existing rights to water or its use. These rights include: first, the rights of owners of riparian lands and lands containing percolating waters or other underground sources of water supply, and second, rights based on appropriation, diversion or use of water by others than riparian owners or owners of so-called overlying lands. If any proposed appropriation, diversion or use of water, to be authorized by or under authority of the law of the state, should violate or

prejudicially affect such existing rights, then the owners of such rights should be awarded just compensation for any damage which they may suffer.

In the foregoing we have not attempted any technical statement of water rights or any nice distinctions, but have sought in a broad way to call your attention to the nature of the problem and the rights involved, and made our suggestions as to how the state might proceed with due deference to private rights and constitutional principles, and trust that our suggestions may prove of some value to you in the performance of your duties.

Dated, October 27, 1928.

Respectfully submitted.

HENRY E. MONROE,
Chairman.
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LOUIS BARTLETT,
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EDWARD F. TREADWELL,
Committee.

I concur in such parts of the foregoing report as are consistent with a separate report filed by me herewith.

SAMUEL C. WIEL.

EXHIBIT "B"

REPORT ON KENNETT RESERVOIR DEVELOPMENT

AN ANALYSIS OF METHODS AND EXTENT OF FINANCING BY ELECTRIC POWER REVENUE

By Lester S. Ready,
Consulting Engineer

A REPORT TO THE JOINT LEGISLATIVE COMMITTEE OF 1927 ON WATER RESOURCES

October, 1928

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF ENGINEERING AND IRRIGATION
EDWARD HYATT, State Engineer

BULLETIN No. 20

REPORT

on

Kennett Reservoir Development

An Analysis of Methods and Extent of Financing by Electric Power Revenue

By
LESTER S. READY
Consulting Engineer

A Report to the Joint Legislative Committee
of 1927 on Water Resources

CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1929



Kennett Dam Site in Sacramento Canyon

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LETTER OF TRANSMITTAL, STATE ENGINEER TO CHAIRMAN OF JOINT LEGISLATIVE COMMITTEE ON WATER RESOURCES

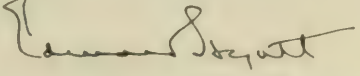
Mr. B. S. Crittenden, Chairman,
Joint Legislative Committee on Water Resources,
Tracy, California.

SUBJECT: WATER RESOURCES INVESTIGATION

Sir: In accordance with request of your committee there has been prepared and is being transmitted herewith, a report on certain phases of the Kennett reservoir, a unit of the "Coordinated Plan" for the development of the water resources of California. This report, prepared under the direction of Mr. Lester S. Ready, consulting engineer, deals particularly with the method and extent of financing this unit by revenues from electric power and is based upon estimates set forth in Bulletin No. 13 entitled "The Development of the Upper Sacramento River," published by this Division.

In the preparation of Bulletin No. 13, the basic consideration under the statute (chapter 477, Statutes of 1925) directing such report, was that of maximum utilization of the water resources of the State. The electric power installation was determined in accord with this mandate. In the following report, however, the consideration is one of economic immediate installation from present commercial viewpoint. Therefore, the conclusions of Bulletin No. 13 have been altered somewhat in this respect. The exact desirable installation can not be accurately stated until the manner of the disposition of the power is known. Whatever size is decided upon, provision should be made for future enlargement to that described in Bulletin No. 13, so that the maximum use of the water resources may be utilized.

Very truly yours,



State Engineer.

Sacramento, California, January 4, 1929.

LETTER OF TRANSMITTAL, AUTHOR TO STATE ENGINEER

Mr. Edward Hyatt,
State Engineer,
Sacramento, California.

Sir: Submitted herewith is a report on "Kennett Reservoir Development, an Analysis of Methods and Extent of Financing by Electric Power Revenue," prepared in compliance with your request.

Although the analysis and conclusions are set forth in fairly concise manner in the report, matters of outstanding importance are summarized in this letter.

SUBJECT OF REPORT.

The Kennett reservoir was selected from several considered in the "Coordinated Plan" of water development in the Sacramento and San Joaquin valleys as being one of the principal units in that plan and in many respects typical of the various units. The analysis made, data submitted and deductions set forth will be applicable in general to other units of the plan with modifications, however, for operating characteristics and geographic location.

The specific Kennett development considered was that contemplating a 420-foot dam, a 2,940,000 acre-foot reservoir and a power plant of 275,000 kilovolt-amperes (220,000 kilowatts) capacity, costing in total $70,000,000. The figures for the power plant capacity and total cost differ from those under Bulletin No. 13, "The Development of the Upper Sacramento River," issued by Division of Engineering and Irrigation, where they are given as 400,000 kilovolt-amperes and $80,000,000, respectively. The power plant capacity was reduced to 275,000 kilovolt-amperes after a study of power values revealed that the latter was the more economic commercial installation under present conditions. The difference in cost is due to this change and to a reduction of interest rate during construction, from 6 per cent to 4.5 per cent.

The development has been analyzed as suggested by you, based upon the operation of the reservoir coordinately for:

1. Control of salinity to Antioch in the delta of the Sacramento and San Joaquin rivers.
2. Control of floods on the Sacramento River to 125,000 second-feet maximum, measured at Red Bluff.
3. An irrigation supply for San Joaquin Valley (330,000 acre-feet per season; 1000 second-feet maximum rate of flow) and additional water for Sacramento Valley.
4. Generation of power consistent with the primary uses of the reservoir as above set forth.

Five plans of financing suggested have been studied, the plans being:

1. Reservoir, dam and power plant financed and operated by private capital.
2. Reservoir and dam financed and operated by the state; power plant financed and operated by private capital; use of water for

power generation sold by State to private interests financing the power plant.

3. Reservoir, dam and power plant financed and operated by State: the power output wholesaled at the power plant.

4. Reservoir, dam and power plant and main trunk transmission lines to important load centers in northern California, financed and operated by the State; power wholesaled at substations to political subdivisions and privately-owned public utilities.

5. Reservoir, dam and power plant, main trunk transmission lines and substations, steam standby plants and general secondary transmission and distribution systems financed and operated by the State; power retailed to the general public.

In each of these plans the State is to retain control of the operations of the dam and reservoir in so far as it affects release of water for salinity or flood control and irrigation supply.

CONCLUSIONS FROM INVESTIGATION.

Ability of the market to absorb Kennett output.

1. The power market tributary to the Kennett development is that existing generally north of Stanislaus County within a distance of approximately 300 miles of Kennett.

2. This market required the production in 1927 of 3,219,000,000 kilowatt hours, and by 1936, the earliest that Kennett may be expected to be completed, will require approximately 5,328,000,000 kilowatt hours annually.

3. Over 65 per cent of the tributary power market is located within 50 miles radius of San Francisco.

4. The tributary market at present is served through two main systems; one including the Pacific Gas and Electric Company and connecting companies supplying 75 per cent; the other, the Great Western Power Company of California supplying 25 per cent of the requirements.

5. The average annual power output of Kennett based upon a plant installation of 275,000 kilovolt-amperes is estimated at 1,217,000,000 kilowatt hours, varying from 990,000,000 to 1,314,000,000 kilowatt hours.

6. The present development of power in northern California is almost entirely from hydro-electric plants, steam-electric plants being used for standby purposes primarily. A greater proportion of the energy required should be developed by steam-electric plants before Kennett is completed.

7. The output of Kennett represents the growth of load for the entire northern market for 4 years. Approximately 5¼ years would be required for the growth of load on the system of the Pacific Gas and Electric Company and connecting companies to absorb the entire output.

8. With coordination of future developments between the State and the existing agencies, the growth in load prior to the completion of Kennett could be carried by steam-electric plants, thus materially reducing the burden of absorption of Kennett output.

9. With reasonable cooperation between the State and the existing agencies, absorption of Kennett output will present no serious diffi-

culties under Plans 1, 2, 3 and 4. The existing utilities have met problems relatively greater than the absorption of the output of Kennett presents. The Pacific Gas and Electric Company in 1925 brought in its own Pit No. 3 plant and took delivery from the City of San Francisco and the California-Oregon Power Company, a total representing over 40 per cent of its then existing load. This compares with Kennett output which represents approximately 25 per cent of the load that would be tributary in 1936. A similar condition was met by the Great Western Power Company in 1921.

Cost of Kennett Development

The estimated cost of Kennett reservoir, dam and power plant is:

Land and improvements flooded	$22,882,000
Dam	30,118,000
Total	$53,000,000
Power plant	17,000,000
Total	$70,000,000

The annual cost of Kennett reservoir, dam and power plant, which is set forth in detail for Plans 1, 2 and 3, varies depending upon the basis of treatment of taxes on private capital and amortization of State bonds. The limits of the estimated costs are as follows:

	Total	*Mills per kwh. of output*
Plan 1. Complete private ownership:		
(a) Including state taxes	$6,867,000	5.64
(b) Excluding state taxes	6,231,000	5.12
Plan 2. State ownership of reservoir and private ownership of power plant:		
(a) With 40-year straight line amortization of state bonds and state taxes on private capital	5,983,000	4.91
(b) With 40-year sinking fund amortization of state bonds and state taxes excluded	4,985,000	4.09
Plans 3, 4 and 5. State ownership:		
(a) With 40 year straight line amortization of bonds	5,668,000	4.66
(b) With 40-year sinking fund amortization of bonds	4,652,000	3.82
(c) Excluding bond amortization	3,918,000	3.22

Plan 4 will require additional capital for transmission lines and substations by the State, amounting as a minimum to $9,600,000. The added cost assuming wholesaling of power to the main utilities at a point near the center of load based on 4 per cent sinking fund amortization is estimated at $784,000 per annum.

Value of power.

The value of power delivered from Kennett power plant to transmission as indicated by the cost of power from other hydro-electric plants is from 2.7 to 3.3 mills per kilowatt hour of power plant output; as indicated by steam power development, the value is from 3.45 to 3.68 mills per kilowatt hour; and as indicated from comparison with existing contracts, approximately 3.45 mills per kilowatt hour.

Revenue from power.

The revenue that may be obtained from the sale of power output at Kennett plant may not be expected to exceed $4,250,000 per annum, and at the terminal of transmission near the Bay district, not to exceed $5,300,000, or approximately 3.5 and 5 mills per kilowatt hour delivered, respectively. Under complete control and operation of Kennett reservoir for irrigation the value of power output will be reduced to approximately $2,000,000 per annum based upon plant delivery.

Plan 5.

Plan 5, contemplating distribution of the total power output by the State, will require duplication of existing systems or condemnation of at least one-quarter of the distribution systems of northern California and the added capital expenditure of over $110,000,000.

It is doubtful if this action would assist the State in the carrying of the costs of Kennett development beyond which would be possible under Plan 3 or 4.

Other revenue required.

By comparison of the cost of Kennett with the revenue from power at the plant of $4,250,000, or to substation delivery of $5,300,000, probable maximum, it is apparent that power can not carry much more than the cost of interest, depreciation and operating expenses of Kennett even under State development. Other sources of revenue such as State or Federal aid, sale of water for irrigation or payments by other beneficiaries would be needed to cover the full amortization requirements of State bonds. The amount of aid required would be minimized by extending the amortization period of State bonds beyond the period of forty years assumed in this report.

Very truly yours,

Leila S. Ready

Consulting Engineer.

San Francisco, California, October 23, 1928.

REPORT ON

Kennett Reservoir Development

An Analysis of Methods and Extent of Financing by Electric Power Revenue

AUTHORITY FOR REPORT.

This report is prepared in compliance with request of Mr. Edward Hyatt, State Engineer, and of the Joint Legislative Committee on Water Resources for the State of California, that a study and analysis be made of the financial and economic phases of the proposed Kennett reservoir.

SUBJECT OF REPORT.

The "Coordinated Plan" for water development in the Sacramento and San Joaquin valleys contemplates several large reservoirs for the storage of water for flood and salinity control and irrigation. Considerable electric power can be developed incidental to and in connection with these reservoirs. The Kennett reservoir has been selected for analysis as being one of the principal units of the "Coordinated Plan," and typical in many respects of the several units of this plan. The analysis made, data submitted and deductions set forth will in general be applicable to the other units of the plan with modifications, however, for operating characteristics and geographic location.

This study and report deals with the relative value of several plans of financing the Kennett unit, and the extent to which it can be financed by revenue from electric power that can be generated at the dam.

The analysis is based on the operation of the reservoir coordinately for:

1. Control of salinity to Antioch in the delta of the Sacramento and San Joaquin rivers.
2. Control of floods on Sacramento River to 125,000 second-feet maximum, measured at Red Bluff.
3. Irrigation supply for San Joaquin Valley (330,000 acre-feet per season: 1000 second-feet maximum rate of flow) and additional water for Sacramento Valley.
4. Generation of power consistent with the primary uses of the reservoir as above set forth.

Although the primary purposes of this reservoir are for flood and salinity control and irrigation, the requirements for irrigation during the early period of use, apparently, will not seriously interfere with the power output, which will be relatively large. Therefore, an important element to be considered in connection with the financial analysis is the value of the power output and the extent to which it may carry the financial burden of the development.

Five different plans for the financing of the development have been suggested for special consideration. In each plan the State is to retain control of the operation of the dam and reservoir in so far as it affects

the release of water for salinity control, flood control and irrigation supply for San Joaquin Valley.

The five plans suggested are:

1. Reservoir, dam and power plant financed and operated by private interests.

2. Reservoir and dam financed and operated by the State. Power plant financed and operated by private interests; use of water for power generation sold by State to private interests financing the power plant.

3. Reservoir, dam and power plant financed and operated by State; power output wholesaled at the power plant.

4. Reservoir, dam and power plant, and main trunk transmission lines to important load centers in northern California financed and operated by the State. Power wholesaled at substations to political subdivisions and privately-owned public utilities.

5. Reservoir, dam and power plant, main trunk transmission lines and substations, steam-electric standby plants and general secondary transmission and distribution systems financed and operated by the State. Power retailed to general public.

A modification of Plan 3, considered herein as Plan 3a, has also been suggested. This plan contemplates the disposition of part of the power at the power plant by sale to municipalities and resale companies. It is suggested that the large private power company or companies purchasing the bulk of the power be required under contract to act as common carriers transmitting the power for compensation from the power plant to the respective municipalities or resale companies.

The general benefits to central and northern California resulting from irrigation, flood control and salinity control, and to San Joaquin Valley for irrigation, are not considered in this report, the report being limited primarily to an analysis of the financial, economic and engineering phases of the development as affected by the disposition of power which may be produced.

SCOPE OF INVESTIGATION.

The investigation carried on in connection with this report has consisted of a study and analysis of the Kennett development with reference to annual cost, potential output and characteristics of the power to be produced, both when operated as suggested and when ultimately operated primarily for irrigation demands. This latter condition must be given some consideration in order that a clear perspective of the future financial situation may be obtained.

Study and analysis of the power market tributary to Kennett and the present and future ability of the market to absorb the output under the different plans presented have been made. The value of the power output has been determined from study of cost of power from other sources, both steam-electric and hydro-electric, and the price for power as indicated by wholesale purchase contracts. The probable power revenue to be obtained from Kennett has been estimated. An independent check of the estimated cost of Kennett development as set forth in Bulletin No. 13, "The Development of the Upper Sacramento River," issued by Division of Engineering and Irrigation, has not been

made. The estimate therein has been revised, however, in two particulars. The interest rate has been reduced to the basis of State financing. The size of the power plant has been reduced from 400,000 kilovolt-amperes (the figure used in Bulletin No. 13) to 275,000 kilovolt-amperes. The latter size would appear the more economical development, for the potential power output as viewed from the standpoint of present and probable future cost of power. The basic considerations, in the preparation of Bulletin No. 13, were that of maximum utilization of the water resources of the State rather than the most economic power development considered herein. No detailed layout of a system for complete distribution of power output of Kennett has been made. This matter has been analyzed from a broad consideration of the problem and the determining factors involved.

COOPERATION.

In connection with the investigation and preparation of this report, I have had the full assistance of the engineers of the State Division of Engineering and Irrigation under the direction of Mr. A. D. Edmonston, and the cooperation of the Railroad Commission of the State of California and its engineering department; also of Mr. F. E. Bonner of the Federal Power Commission, and the power companies and municipal electric utilities. I wish to express herein my appreciation of the assistance received.

PROPOSED KENNETT DEVELOPMENT.

The Kennett dam and reservoir as contemplated in Bulletin No. 13 is to be located on the Sacramento River near Kennett, Shasta County, approximately two hundred miles due north of San Francisco. The development includes a dam, 420 feet in height, a reservoir of 2,940,000 acre-feet capacity and a power plant of 275,000 kilovolt-amperes capacity with a potential output of 1,217,600,000 kilowatt hours annually. The reservoir will flood 23,000 acres of land. The main line of the Southern Pacific Company and a portion of the State highway will have to be relocated. The estimated cost of the development, including the dam, reservoir, flood control features and power plant, is $70,000,000. This estimate of cost includes interest during construction on basis of State financing. Though under private development interest rates would be higher, the analysis for clarity has been based upon equal capital cost, the difference being within the accuracy of the estimate.

The above covers the development as outlined in Bulletin No. 13, except as to change in power plant capacity, and is the development contemplated in Plans 1, 2 and 3 listed herein. Under Plan 4, State construction of a 220,000-volt transmission line would be added, and, under Plan 5, extensive purchase of existing electric transmission and distribution systems or duplication thereof would be necessary to dispose of the power.

IMPORTANT QUESTIONS INVOLVED.

Following are certain of the important features to be considered in the analysis:

1. The ability of the electric power market to absorb the output of the development when completed.
2. The investment and annual cost of the development under the several plans proposed.

3. The value of power and the amount of revenue from power which may be obtained by the sale of the output of the Kennett development.

4. The effect of the ultimate operation of the reservoir primarily for irrigation on the value of power output.

The first four of the five proposed plans of financing Kennett involve in general the same conditions with reference to the ability of the market to absorb the power output. The power would be delivered to the main existing agencies. Investment costs would be practically the same in total and the annual costs and revenues are subject to definite comparisons. The fifth plan contemplates a material departure from the other four and would be subject to special and separate consideration.

ABILITY OF POWER MARKET TO ABSORB OUTPUT OF KENNETT

DESCRIPTION OF PRESENT POWER DEVELOPMENTS OF THE STATE

A. Extent and grouping of systems

The electric power development of the state has experienced a rapid and steady growth during the past twenty-five years. During this period, interconnections and consolidations have occurred until at the present time, the supplying of electric power is through four main networks or groupings of systems. These are set forth on Plate I, "Electric Power Production and Transmission Systems in California, December 31, 1927," which shows the location of the hydro-electric and steam-electric plants and the main transmission systems in the State:

System I—Includes Pacific Gas and Electric Company and its subsidiary companies; The California-Oregon Power Company; Snow Mountain Water and Power Company; City of San Francisco and Coast Counties Gas and Electric Company.

This network, extending from the northern boundary of the State to the Salinas Valley, represents the largest northern system and has transmission lines nearest Kennett.

System II—Includes Great Western Power Company of California and its allied companies, San Joaquin Light and Power Corporation and Midland Counties Public Service Corporation; also the Modesto and Turlock Irrigation Districts and the Merced Irrigation District.

System III—Consists mainly of the Southern California Edison Company, the City of Los Angeles and the City of Pasadena.

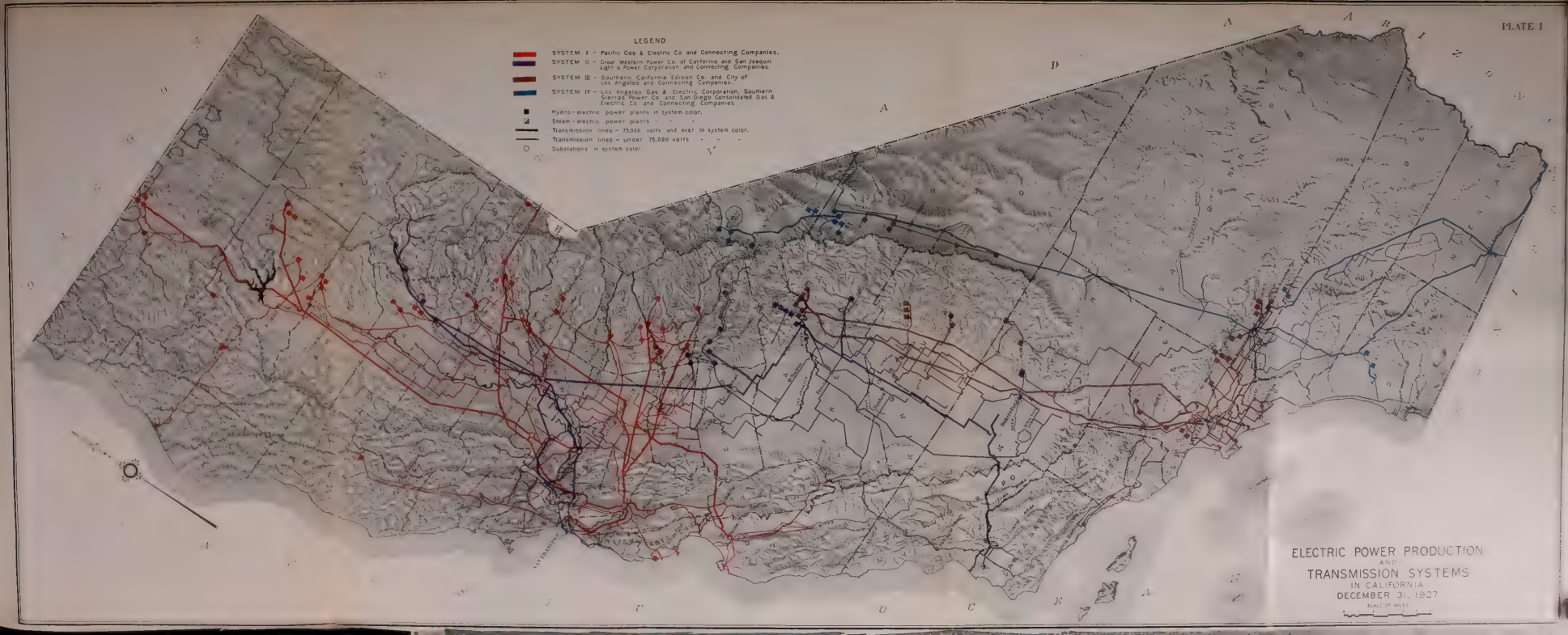
System IV—Includes Southern Sierras Power Company, Los Angeles Gas and Electric Corporation, and San Diego Consolidated Gas and Electric Company, operating in the southern and eastern portions of the State, which, although not fully connected at this time, will be a connected system within the near future.

It is to be noted that System I is nearest in distance to the Kennett reservoir, which is shown in "black" on Plate I. System II is somewhat further south, although the Great Western Power Company serves a territory generally the same as that served by the Pacific Gas and Electric Company and its connecting companies. Systems III and IV serve the southern part of the State, the market supplied being from 456 to 600 miles from Kennett. This distance is such that from an economic standpoint the market served by these companies is not available to absorb the power from Kennett. This is also largely true of the market served by the San Joaquin Light and Power Corporation.

B. Extent and distribution of present load or power market

Plate II, "Geographic Location of Electric Power Production and Load in California, 1927," sets forth graphically the location and extent of the power production and market throughout the State for the year 1927 as indicated by existing utility power plant and substation outputs, respectively. The magnitude of the production by dis-

PLATE I



ELECTRIC POWER PRODUCTION AND TRANSMISSION SYSTEMS IN CALIFORNIA DECEMBER 31, 1927

SCALE OF MILES

PLATE II


LEGEND
Electric power production
25,000,000 kilowatt hours
Less than 25,000,000 kilowatt hours
25,000,000 kilowatt hours - Kennett power
Electric power load
25,000,000 kilowatt hours
Less than 25,000,000 kilowatt hours
GEOGRAPHIC LOCATION
OF
ELECTRIC POWER PRODUCTION AND LOAD
IN CALIFORNIA
1927
SCALE OF MILES

tricts or groups of plants and the load by counties is indicated by "dots." Each "full dot" represents 25,000,000 kilowatt hours and each "half dot" an amount less than 25,000,000 kilowatt hours annual output. The potential output of Kennett is also delineated. This plate indicates where kilowatt hours were produced and where used in 1927. It does not show the extent of plant capacities. It is to be noted that the main location of power production is along the Sierra Nevada Mountains from the California-Oregon line to the Kern River, the larger developments being on the Pit, Feather, Tuolumne and San Joaquin rivers. Plates I and II together indicate the general transmission of power southward from the power plants in the Sierra Nevadas to the power load which centers around San Francisco Bay for northern California, and Los Angeles for southern California, with general but much less dense use throughout the Sacramento and San Joaquin valleys. Study of Plate II and the data supporting it indicates that in excess of 65 per cent of the power market of northern California is within a radius of fifty miles of San Francisco; also a like percentage for southern California is located within the same radius of Los Angeles.

DIVISION OF POWER MARKET AND SYSTEMS FOR STUDY OF PROBLEM.

A general study of the sources of power in the State, the systems and the market indicates that for this analysis, the State should be divided into a northern district, comprising generally that portion served by System I and the Great Western Power Company of System II, hereafter referred to as "Northern Group," and a southern district. The southern district comprises that portion of the State generally south of Stanislaus County and served by San Joaquin Light and Power Corporation of System II, and System III and System IV, referred to as "Southern Group."

The two districts or groups are connected for interchange of power by the transmission line between the Great Western Power Company and the San Joaquin Light and Power Corporation. This tie-line is available for the shifting of power between the two sections of the State.

Table 1 sets forth by companies the production of power in millions of kilowatt hours and in per cent of the total for the northern and southern groups, respectively. There is also set forth by companies the total substation output in millions of kilowatt hours and in per cent of the totals for the respective groups, eliminating intercompany deliveries. This represents, measured in substation output, the power market served directly by the respective companies.

Table 1 also shows for the Northern Group that System I produced 79 per cent and served directly 75.2 per cent of the entire load in the Northern District; for the Southern Group, the San Joaquin portion of System II produced 18.2 per cent; System III, 66.5 per cent; and System IV, 15.3 per cent of the total power requirements of the Southern District. The San Joaquin system directly serves 16.3 per cent; System III, 67.6 per cent; and System IV, 16.1 per cent of the market of the Southern District.

TABLE 1

Electric Power Production and Substation Delivery by Companies, 1927

Name of company	Production		Substation delivery	
	Millions of kilowatt hours	Per cent of total	Millions of kilowatt hours	Per cent of total
NORTHERN GROUP.				
System I.				
California-Oregon Power Co.	290.3	9.0	24.2	0.9
Pacific Gas and Electric Company and its subsidiary companies	1,624.6	50.5	1,876.5	72.2
City of San Francisco	538.4	16.7	0	0
Snow Mountain Water and Power Co.	53.0	1.7	11.9	0.5
Utica Mining Co.	19.0	0.6	----	---
Coast Counties Gas and Electric Company	4.2	0.1	36.7	1.4
Melones Mining Company	1.7	0.1	0	0
West Side Lumber Company	1.6	0.1	----	---
Truckee River Power Co.	7.6	0.2	4.1	0.2
Total, System I	2,543.6	79.0	1,953.4	75.2
System II-a.				
Great Western Power Co. of California	675.4	21.0	645.6	24.8
Total, northern group	3,219.0	100.0	2,599.0	100.0
SOUTHERN GROUP.				
System II-b.				
San Joaquin Light and Power Corporation	504.4	12.4	515.2	15.0
Merced Irrigation District	126.6	3.1	0	0
Turlock-Modesto Irrigation Districts	104.3	2.5	43.7	1.3
U. S. National Park Service	7.7	0.2	----	---
Total, System II-b	743.0	18.2	558.9	16.3
System III.				
Southern California Edison Company	2,419.5	59.1	1,711.6	49.7
City of Los Angeles	268.8	6.6	567.9	16.5
City of Pasadena	31.6	0.8	49.4	1.4
Total, System III	2,719.9	66.5	2,328.9	67.6
System IV.				
Los Angeles Gas and Electric Corporation	247.1	6.0	247.2	7.2
Southern Sierras Power Co.	265.1	6.5	178.1	5.2
San Diego Consolidated Gas and Electric Co.	109.9	2.7	126.8	3.7
Yuma Project—United States Reclamation Service	5.2	0.1	----	---
Total, System IV	627.3	15.3	552.1	16.1
Total, southern group	4,090.2	100.0	3,439.9	100.0
Northern group	3,219.0	44	2,599.0	43
Southern group	4,090.2	56	3,439.8	57
Grand total, entire State	7,309.2	100	6,038.8	100

The following table summarizes for the state the distribution of production and load among the four systems:

Electric Production and Load in California, 1927

	Millions of kilowatt hours output		Per cent of total	
	Production	Substation output	Production	Substation output
System I	2543.6	1953.3	34.8	32.3
System II-a	675.4	645.6	9.2	10.7
Total, northern group	3219.0	2599.0	44.0	43.0
System II-b	743.0	558.9	10.2	9.3
System III	2719.9	2328.9	37.2	38.6
System IV	627.3	552.1	8.6	9.1
Total, southern group	4090.2	3439.9	100.0	100.0
Total State	7309.2	6038.8	56.0	57 0

DISTRIBUTION OF POWER MARKET BY COUNTIES.

Tables 2, 3-A and 3-B, and Plate III, "Distribution of Electric Power Load by Counties in California, 1927," set forth by counties the distribution of the power load throughout the State. These, together with Plate II, indicate for the market of northern California that 13.8 per cent of the market is located north of Sacramento County; 18.8 per cent in the counties surrounding Sacramento, including the mountain counties as far south as Tuolumne County; 62.7 per cent in the Bay counties; and 4.7 per cent in the counties south of Santa Clara County. The total substation output of this entire part of the State for 1927 was somewhat in excess of twice the potential development of Kennett.

TABLE 2

California Electric Power Load or Market by Counties Measured by Substation Delivery, 1927

County	*Substation delivery, thousands of kilowatt hours*	County	*Substation delivery, thousands of kilowatt hours*
Alameda	449,920	Orange	138,361
Alpine	------	Placer	19,858
Amador	22,846	Plumas	31,523
Butte	35,516	Riverside	132,809
Calaveras	12,802	Sacramento	172,146
Colusa	20,175	San Benito	20,823
Contra Costa	244,397	San Bernardino	239,016
Del Norte	------	San Diego	126,801
El Dorado	2,449	San Francisco	685,775
Fresno	171,885	San Joaquin	123,287
Glenn	21,161	San Luis Obispo	16,423
Humboldt	14,451	San Mateo	91,031
Imperial	40,257	Santa Barbara	57,766
Inyo	8,188	Santa Clara	131,575
Kern	256,869	Santa Cruz	50,591
Kings	43,863	Shasta	16,162
Lake	------	Sierra	------
Lassen	------	Siskiyou	20,584
Los Angeles	1,859,426	Solano	68,792
Madera	33,457	Sonoma	24,306
Marin	32,073	Stanislaus	67,451
Mariposa	3,000	Sutter	22,236
Mendocino	5,535	Tehama	8,351
Merced	69,341	Trinity	6,899
Modoc	------	Tulare	157,694
Mono	------	Tuolumne	18,824
Monterey	50,271	Ventura	56,814
Napa	4,884	Yolo	21,683
Nevada	33,901	Yuba	52,313
Total—Substation delivery by counties			6,016,561
Not segregated—Southern California Edison Co., interdepartmental			22,295
Entire State			6,038,856

GROWTH OF POWER LOAD.

Plate IV, "Electric Power Installation in California, 1911–1927," sets forth for the northern and southern groups and for the entire State, the growth in power developed by plant capacities, both hydro-electric and steam-electric, for the period 1911 to 1927. It is to be noted that in the Northern Group, up to the present time, the amount of hydro-electric capacity in per cent of total is considerably greater than in the Southern Group. Table 4 sets forth statistically the data indicated in Plate IV.

Plate V, "Electric Power Production in California, 1913–1927," presents for the period 1913 to 1927 and for the two groups and the State, the power output by months in thousands of kilowatts (average) for steam-electric and hydro-electric plants, respectively. The fluctuation in steam-electric production should be noted, as the amount is an important factor in the absorption of new hydro-electric developments.

This fluctuation has occurred partly on account of variation of hydro-electric power production between wet and dry years and partly as a result of the bringing in of new hydro-electric plants. The heavy demand for steam-electric power as a result of the 1924 drought is clearly indicated. The material reduction in steam-electric power in the northern part of the State in the past three years has been the result mainly of bringing in three large hydro-electric projects in 1925: Copco No. 2 of The California-Oregon Power Company, Pit No. 3 of the Pacific Gas and Electric Company, and Moccasin Creek plant of the City of San Francisco. The result of bringing in these three developments, having an annual output of approximately 1,000,000,000 kilowatt hours, has been to reduce the steam-electric power production to less than 1 per cent of the total and to create a condition of temporary oversupply.

TABLE 3-A

Substation Delivery by Counties Grouped Geographically

(District Served by Northern Group of Companies)

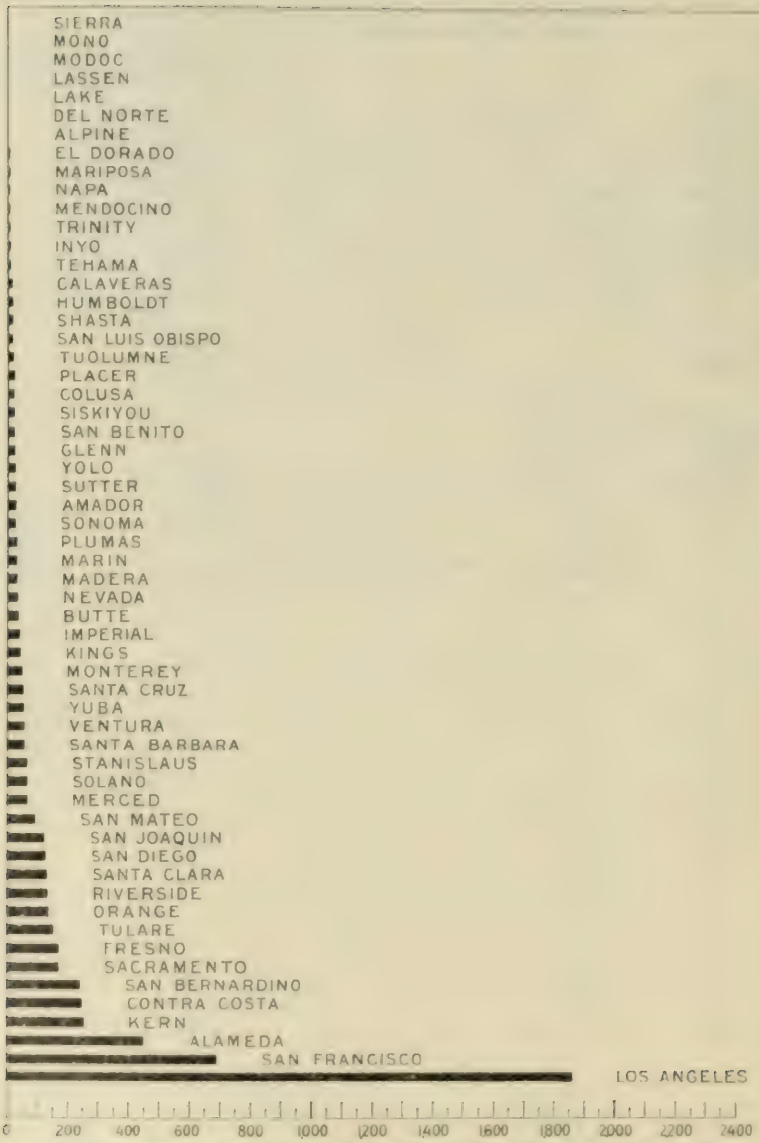
County	*Substation delivery* *Thousands of kilowatt hours*	*Per cent of total northern group*
DISTRICT 1.		
Butte	35,516	
Colusa	20,175	
Del Norte	-----	
Glenn	21,161	
Humboldt	14,451	
Lake	-----	
Lassen	-----	
Mendocino	5,535	
Modoc	-----	
Napa	4,884	
Nevada	33,901	
Placer	19,858	
Plumas	31,523	
Shasta	16,162	
Sierra	-----	
Siskiyou	20,584	
Sonoma	24,306	
Sutter	22,236	
Tehama	8,351	
Trinity	6,899	
Yolo	21,683	
Yuba	52,313	
Total, District 1	359,538	13.8
DISTRICT 2.		
Alpine	-----	
Amador	22,846	
Calaveras	12,802	
El Dorado	2,449	
Sacramento	172,146	
San Joaquin	123,287	
Solano	68,792	
Stanislaus	67,451	
Tuolumne	18,824	
Total, District 2	488,597	18.8
DISTRICT 3.		
Alameda	449,920	
Contra Costa	244,397	
Marin	32,073	
Santa Clara	131,575	
San Francisco	685,775	
San Mateo	91,031	
Total, District 3	1,634,771	62.7
DISTRICT 4.		
Monterey	50,271	
San Benito	20,823	
Santa Cruz	50,591	
Total, District 4	121,685	4.7
Total Northern California	2,604,591	100.0

TABLE 3-B

Substation Delivery by Counties Grouped Geographically
(District Served by Southern Group of Companies)

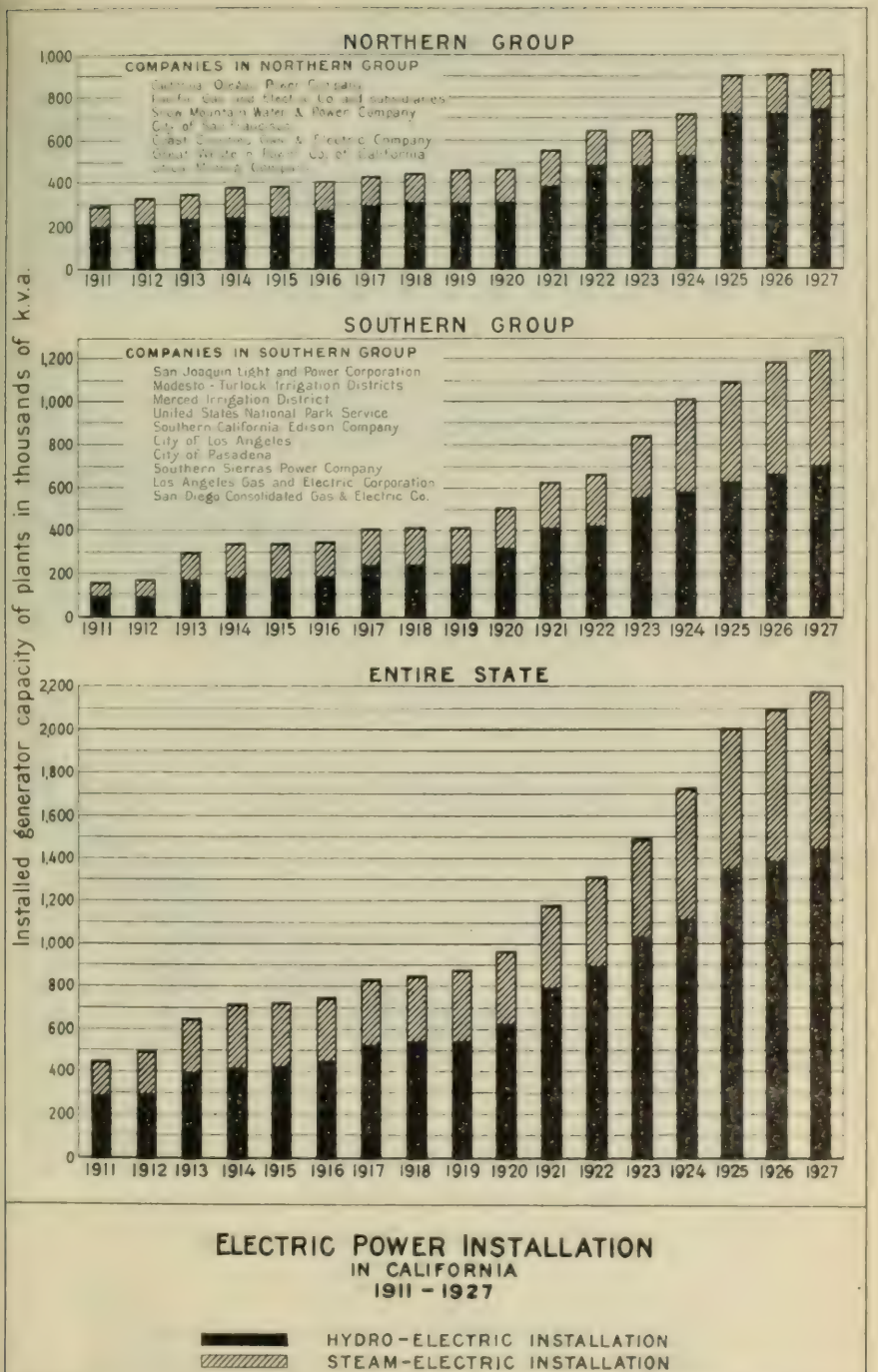
County	*Substation delivery* *Thousands of kilowatt hours*	*Per cent of total southern group*
DISTRICT 1.		
Fresno	171,885	
Inyo	8,188	
Kern	256,869	
Kings	43,863	
Madera	33,457	
Mariposa	3,000	
Merced	69,341	
Mono	-----	
San Luis Obispo	16,423	
Santa Barbara	57,766	
Tulare	157,694	
Total, District 1	818,486	24.0
DISTRICT 2.		
Los Angeles	1,859,426	
Orange	138,361	
Ventura	56,814	
Total, District 2	2,054,601	60.2
DISTRICT 3.		
Imperial	40,257	
Riverside	132,809	
San Bernardino	239,016	
San Diego	126,801	
Total, District 3	538,883	15.8
Total South San Joaquin Valley and southern California	3,411,970	100.0

PLATE III



DISTRIBUTION OF ELECTRIC POWER LOAD BY COUNTIES IN CALIFORNIA 1927

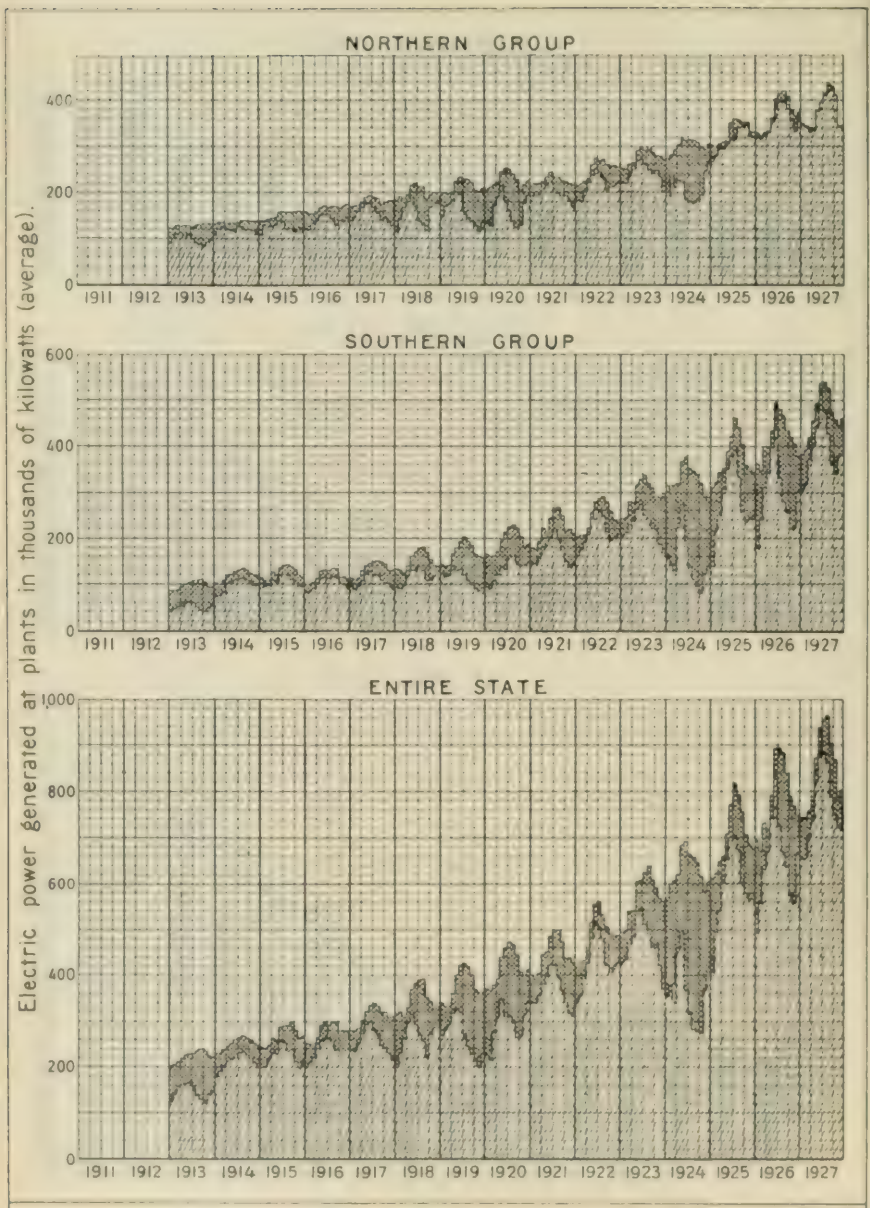
PLATE IV.



ELECTRIC POWER INSTALLATION
IN CALIFORNIA
1911 - 1927

HYDRO-ELECTRIC INSTALLATION
STEAM-ELECTRIC INSTALLATION

PLATE V.



ELECTRIC POWER PRODUCTION
IN CALIFORNIA
1913 – 1927

POWER PRODUCED BY HYDRO-ELECTRIC PLANTS

POWER PRODUCED BY STEAM-ELECTRIC PLANTS

TABLE 4

Electric Power Installation in California, December 31 of each year, 1911–1927

Year	NORTHERN GROUP			SOUTHERN GROUP			ENTIRE STATE		
	Hydro-electric installation k.v.a	Steam-electric installation k.v.a	Total electric installation k.v.a.	Hydro-electric installation k.v.a.	Steam-electric installation k.v.a.	Total electric installation k.v.a.	Hydro-electric installation k.v.a.	Steam-electric installation k.v.a.	Total electric installation k.v.a.
1911	196,795	94,575	291,370	85,585	69,577	155,162	282,380	164,152	446,532
1912	202,795	126,575	329,370	85,585	79,977	165,562	288,380	206,552	494,932
1913	226,795	121,375	348,170	167,835	130,217	298,052	394,630	251,592	646,222
1914	239,295	136,375	375,670	173,835	166,967	340,802	413,130	303,342	716,472
1915	241,170	141,675	382,845	174,435	166,367	340,802	415,605	308,042	723,647
1916	268,475	132,950	401,425	179,935	166,212	346,147	448,410	299,162	747,572
1917	286,725	141,950	428,675	236,616	168,946	405,562	523,341	310,896	834,237
1918	302,075	141,810	443,885	236,616	168,946	403,562	538,691	310,756	849,447
1919	300,575	156,810	457,385	241,466	168,547	410,013	542,041	325,357	867,398
1920	301,725	156,810	458,535	320,066	183,647	503,713	621,791	340,457	962,248
1921	378,822	169,310	548,132	409,916	216,097	626,013	788,738	385,407	1,174,145
1922	472,872	169,310	642,182	417,666	248,247	665,913	890,538	417,557	1,308,095
1923	471,972	175,200	647,172	551,824	288,697	840,521	1,023,796	463,897	1,487,693
1924	527,320	187,625	714,945	577,824	432,097	1,009,921	1,105,144	619,722	1,724,866
1925	718,320	187,625	905,945	627,324	467,645	1,094,969	1,345,644	655,270	2,000,914
1926	720,820	187,625	908,445	661,074	522,245	1,183,319	1,381,894	709,870	2,091,764
1927	744,445	187,625	932,070	699,024	540,995	1,240,019	1,443,469	728,620	2,172,089

Table 5 sets forth by years the production of power, both hydro-electric and steam-electric in millions of kilowatt hours for the years 1913 to 1927. The figures include a relatively small production of power by plants of the California-Oregon Power Company and the Truckee River Power Company outside the State.

TABLE 5

Electric Power Production in California, 1913–1927

Year	Annual power plant output in millions of kilowatt hours: Hydro-electric	Steam-electric	Total	Steam-electric in per cent of total
Northern group[a]				
1913	852	266	1118	23.8
1914	1028	146	1174	12.4
1915	1072	220	1292	17.0
1916	1219	208	1427	14.6
1917	1332	242	1574	15.4
1918	1350	386	1736	22.2
1919	1343	473	1816	26.0
1920	1409	576	1985	29.0
1921	1719	253	1972	12.8
1922	1905	268	2173	12.3
1923	2118	302	2420	12.5
1924	1833	812	2645	30.7
1925	2721	162	2883	5.6
1926	3102	130	3232	5.0
1927	3266	32	3298	1.0
Southern group				
1913	439	414	853	48.5
1914	858	173	1031	16.8
1915	911	170	1081	15.7
1916	894	137	1031	13.3
1917	930	242	1172	20.6
1918	1014	319	1333	23.9
1919	994	491	1485	33.1
1920	1163	543	1706	21.8
1921	1485	449	1934	13.2
1922	1886	287	2173	13.2
1923	1995	627	2622	13.9
1924	1335	1561	2896	53.5
1925	2462	836	3298	25.3
1926	2577	1091	3668	29.7
1927	3443	644	4087	15.8
Entire State[a]				
1913	1291	680	1971	34.5
1914	1886	319	2205	14.5
1915	1983	390	2373	16.4
1916	2113	345	2458	14.0
1917	2262	484	2746	17.6
1918	2364	706	3069	23.0
1919	2337	964	3301	29.2
1920	2572	1119	3691	30.3
1921	3204	702	3906	18.0
1922	3791	555	4346	12.8
1923	4113	929	5042	18.4
1924	3168	2373	5541	42.8
1925	5183	998	6181	16.1
1926	5679	1221	6900	17.7
1927	6709	676	7385	9.2

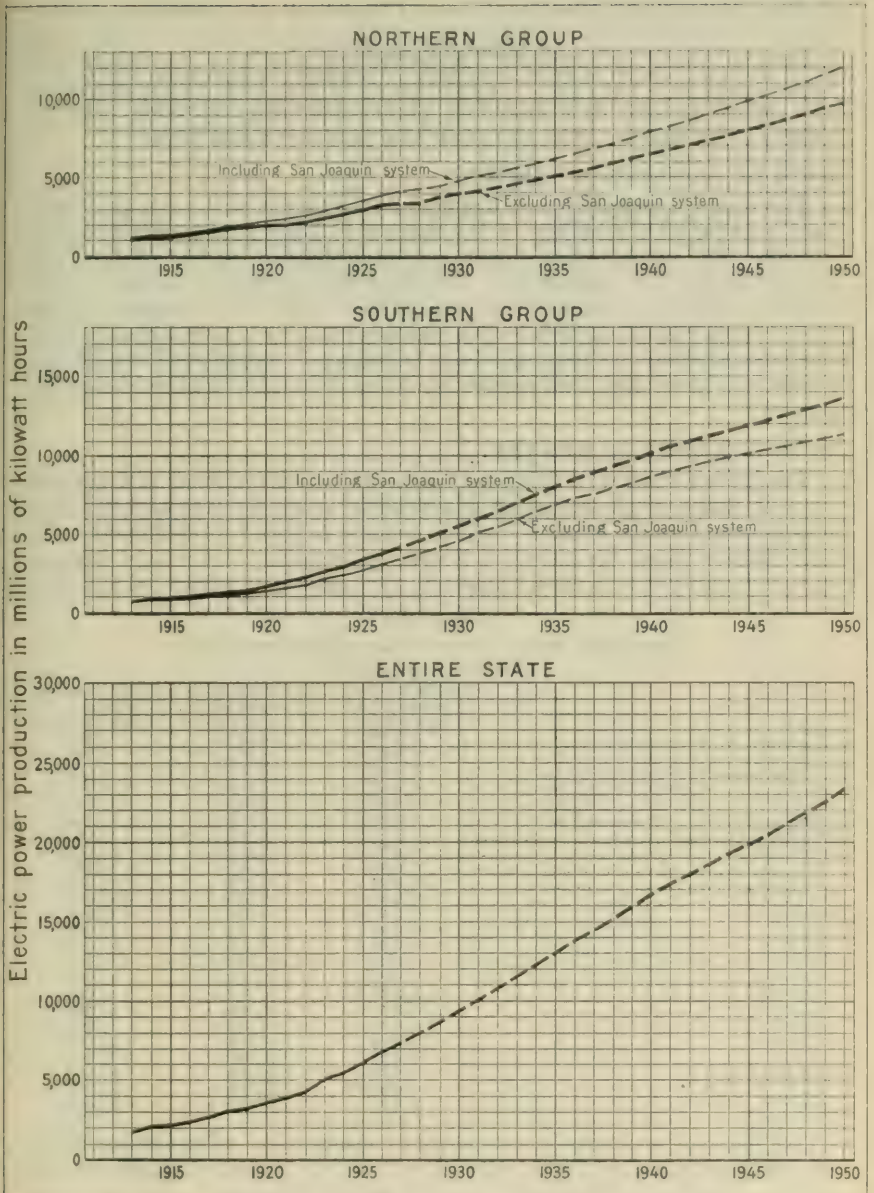
[a] Limited production outside of State included.

ESTIMATED FUTURE GROWTH OF POWER REQUIREMENTS.

An important factor in determining the ability of the market to absorb the output of the Kennett development is the extent of the market and the rate of growth, especially just prior to and following the completion of such a plant.

Numerous estimates have been made of the future growth of power in the State of California. The past growth in northern California has been steady, though not as rapid as in southern California. There has been apparently some slowing up of the growth in southern California during the past few years. Studies of estimates of growth of power requirements prepared by Mr. F. E. Bonner of the Federal Power Commission, together with other analyses of past and estimated

PLATE VI.



PAST AND ESTIMATED FUTURE GROWTH
OF
ELECTRIC POWER PRODUCTION
IN CALIFORNIA
1913 – 1950

ELECTRIC POWER PRODUCTION FOR PAST YEARS
ESTIMATED ELECTRIC POWER PRODUCTION FOR FUTURE YEARS

Future Growth of Electric Power Production in California, 1913-1950," and in Table 6 for the two sections of the State. The past growth of power in northern California has been at a compound rate approximating 8 per cent. The estimates herein, however, contemplate the future growth at a reducing percentage, ranging from approximately 7 per cent in 1928, to as low as 4 per cent about 1950.

DATE OF BRINGING IN KENNETT.

The date of completion of Kennett development will have an important bearing on the ability of the market to absorb its potential power output. The construction program contemplates a period of four and one-half years for completion. Allowing for preliminaries and financing, it may be concluded that the earliest time for bringing in this development would be 1935. For the purposes of this discussion, however, completion by 1936 has been assumed. Should the completion occur at a later date, the market could more readily absorb the power output.

POWER OUTPUT OF KENNETT.

The power output of Kennett, when operated for flood and salinity control, and limited irrigation, is estimated at an average of 1,217,600,000 kilowatt hours annually. This output is based on a 275,000 kilovolt-ampere plant operating at 80 per cent power factor and with an output equivalent to approximately 70 per cent plant load factor.

TABLE 6

Estimated Future Power Requirement, 1927–1950

(Power Plant Output)

Year	Northern Group, millions of kilowatt hours	Southern Group, millions of kilowatt hours	Entire State, millions of kilowatt hours
1927	3,219	4,090	7,309
1928	3,433	4,572	8,005
1929	3,668	5,054	8,722
1930	3,919	5,492	9,411
1931	4,125	6,017	10,142
1932	4,343	6,499	10,842
1933	4,570	6,981	11,551
1934	4,811	7,507	12,318
1935	5,063	8,032	13,095
1936	5,328	8,470	13,798
1937	5,606	8,908	14,514
1938	5,897	9,346	15,243
1939	6,205	9,740	15,946
1940	6,539	10,178	16,717
1941	6,806	10,573	17,379
1942	7,083	10,923	18,006
1943	7,372	11,273	18,646
1944	7,673	11,624	19,297
1945	7,984	11,930	19,914
1946	8,310	12,237	20,547
1947	8,647	12,587	21,234
1948	8,997	12,938	21,935
1949	9,362	13,201	22,563
1950	9,728	13,551	23,279

These bases of estimates are somewhat conservative. The output under the conditions as set forth will vary from a minimum of 990,400,000 kilowatt hours to a maximum of 1,314,000,000 kilowatt hours annually. Table 7 sets forth the estimated output which could have been developed under the water supply conditions of 1896–1927 had Kennett been installed. The relative variation of output both annually and monthly, compared with other typical plants, is presented graphically on Plate VII, "Variation of Annual and Monthly Power Output of Kennett Reservoir Compared with Typical Hydro-electric Plants."

The Kennett output for the minimum year has been estimated to meet the normal variation of power demand on the main power systems and is under these conditions more valuable than that from the other plants. Although shown as uniform throughout the maximum year, the output could be varied to follow more closely the power demand.

The output characteristics under condition of practically complete control for irrigation, which will ultimately occur, are very different and will materially reduce the value of the power available. An estimate of the conditions under such control based on a use of water to the level of two hundred feet above the stream bed indicates an average annual output of 767,000,000 kilowatt hours with a variation in output from 46 per cent to 138 per cent of the average. Unless such a limit on the minimum head is provided much less power could be produced in the dry years and the value of the output would be materially reduced.

TABLE 7

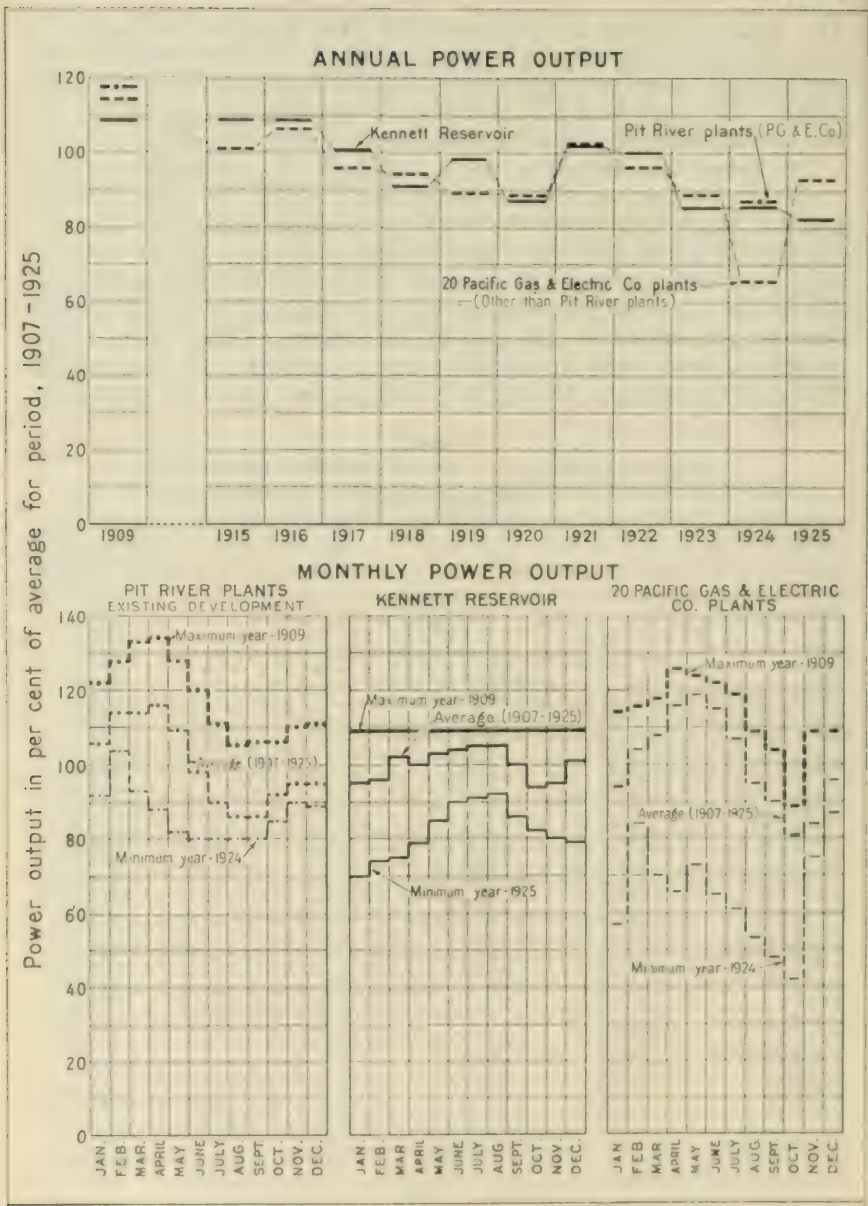
Estimated Power Output, Kennett Reservoir—420 foot dam

Operated for Flood Control, Saline Control and an Irrigation Supply to San Joaquin Valley.

Installed Capacity of Plant, 275,000 k.v.a. Power Factor = 0.80. Load Factor = 0.75

Year	*Power output in millions of kilowatt hours*
1896	1310.7
1897	1287.9
1898	1074.7
1899	1104.0
1900	1242.9
1901	1192.5
1902	1288.5
1903	1252.5
1904	1314.0
1905	1288.6
1906	1314.0
1907	1314.0
1908	1291.2
1909	1314.0
1910	1283.8
1911	1308.7
1912	1240.0
1913	1229.7
1914	1314.0
1915	1314.0
1916	1314.0
1917	1215.8
1918	1098.6
1919	1186.3
1920	1054.5
1921	1227.7
1922	1208.0
1923	1031.7
1924	1035.4
1925	990.4
1926	1049.6
1927	1271.5
Average: 1896-1927	1217.6

PLATE VII.



VARIATION OF ANNUAL AND MONTHLY POWER OUTPUT OF KENNETT RESERVOIR COMPARED WITH TYPICAL HYDRO-ELECTRIC PLANTS

MARKET AVAILABLE AT TIME OF COMPLETION.

Upon completion of Kennett, assumed as occurring in 1936, its power output of 1,217,600,000 kilowatt hours annually would be entering the market of northern California, estimated as requiring the production of 5,328,000,000 kilowatt hours annually. The demands of the territory at that time must and will be fully served by existing agencies. These agencies are at present grouped in two systems, one supplying approximately 75 per cent, and the other 25 per cent of the market. The market will face the absorption of an added supply of approximately 23 per cent of the then existing production, assuming complete coordination of the existing agencies. If the larger of the two systems is to absorb the output it will face the absorption of 31 per cent added supply.

The estimated growth of the market of northern California during the period 1935 to 1940 is at a rate of approximately 300,000,000 kilowatt hours per annum or one-fourth of the total estimated output of Kennett. The market will take, therefore, from four to five years for the growth of load to absorb the entire output, depending upon the extent of cooperation and coordination obtained.

IMPORTANCE OF COORDINATED DEVELOPMENT.

From a standpoint of economic absorption of power output, such as Kennett, the amount of steam-electric power produced at the time of completion of the project is important.

It is economic, also the general practice of utilities in bringing in any large hydro-electric plant, to carry the growth of load for one or two years prior thereto on steam-electric plants so that a considerable load may be immediately shifted to the hydro-electric plants and thus reduce expenses as fixed charges are increased. At present the most economic balance between hydro-electric and steam-electric power production does not exist, there being too small a percentage of steam-electric power produced.

The Pacific Gas and Electric Company has under construction added power plants on the Mokelumne River and plans for development on the Bear and Pit rivers in addition to steam-electric plants. Further development on the Feather River by the Great Western Power Company may be expected as needed by that system. Other private and public enterprises are urging developments on other streams so that, at present, the tendency is toward further development of hydro-electric plants where a more economic procedure would be to meet the growth of load by steam-electric power installation. It is, therefore, important that, through cooperation with the agencies serving the public, their developments be coordinated to make possible the ready absorption of Kennett power output if it is to be wholesaled to them, otherwise the output of Kennett would enter a market not ready for the absorption of such a large added production.

Under Plans 1, 2, 3, and in general, Plan 4, as suggested for consideration, the entire market of northern California tributary to Kennett power may be considered available for absorption of the output through the system of the existing utility agencies. These agencies, through the extent and diversity of their load, have developed a market fully interconnected through their systems with a load factor in excess of 60 per cent and a flexibility such that the power output could be readily

absorbed. If definite obligations for sale and purchase are entered into, under Plans 2, 3 and 4, other developments may be adjusted sufficiently in advance to make possible a minimum period of absorption. Much more extreme problems have been faced and overcome in the past than are presented by Kennett. In 1921, the Great Western Power Company brought in on its own system the first units of the Caribou development, the output of which represented in excess of 40 per cent of the then existing load on that system. In 1925, the Pacific Gas and Electric Company completed its Pit No. 3 plant, commenced the purchase of additional power from the California-Oregon Power Company and the City of San Francisco, the total amount exceeding 40 per cent of its then existing load. Kennett output will represent from 23 per cent to 31 per cent of the load at the time it is available.

With reasonable coordination and cooperation between this development and existing agencies no serious difficulty should arise in the absorption of power produced by Kennett development.

The problem of obtaining a market for the output of Kennett plant were the market to be developed through state-owned and operated distribution systems as suggested in Plan 5, is one to be considered separately.

COST OF KENNETT DEVELOPMENT

INVESTMENT COST.

The cost of the Kennett development (420 foot dam, 2,940,000 acre-foot reservoir) was estimated in Bulletin No. 13, "The Development of the Upper Sacramento River," at $80,000,000. That estimate was prepared on the basis of a power plant capacity of 400,000 kilovolt-amperes and with interest during construction at a rate of 6 per cent per annum. In this report the power plant capacity has been taken at 275,000 kilovolt-amperes as explained on page 52 of this report, and the interest rate reduced to a State financing basis of 4½ per cent. With these revisions the estimated cost is $70,000,000. This covers purchase of reservoir site and removal to new location of the Southern Pacific Company tracks and a part of the State highway that would be submerged, construction of the dam and a 275,000 kilovolt-ampere power plant. The total cost is divided as follows:

Lands and improvements flooded	$22,882,000
Dam and appurtenances	30,118,000
Total reservoir and dam	$53,000,000
Power plant	17,000,000
Total development	**$70,000,000**

ANNUAL COST OF KENNETT DEVELOPMENT.

The annual cost of Kennett development (reservoir, dam and power plant) will vary in the first three of the five plans of financing suggested, owing to differences in costs between private and state ownership and financing. The annual cost of this development will be the same under Plans 3, 4 and 5, as each contemplates complete State ownership of the reservoir, dam and power plant. The annual costs are fully set forth in Table 8 and are based on the following units:

Basis of Estimated Annual Cost Kennett Reservoir and Power Plant

Bond amortization basis	*Private ownership*	*State ownership*		
		Straight line	*Sinking fund*	*Excluded*
Return or interest per cent of capital	7.5	4.5	4.5	4.5
Amortization of state bonds—40 year basis. per cent of capital	--	2.5	1.05	--
Depreciation:				
Land and improvements, per cent of capital	--	--	--	--
Dam and appurtenances, per cent of capital	.3	.3	.3	.3
Power plant, 40 year basis, per cent of capital	.65	1.05	1.05	1.05
Taxes:				
State, per cent of capital	1.35			
Federal, per cent of capital	.40			
Operating expense and maintenance, both private and state ownership	$200,000 per annum for dam and reservoir. $300,000 per annum for power plant.			

Return on private investment is that at present generally estimated as fair for large electric projects such as Kennett. The interest rate of 4.5 per cent for State investment is slightly above the present cost. Amortization is assumed on a basis of a forty-year period commencing ten years after date of issue of bonds. This period is within the legal limit for State bonds (seventy-five years). Ten years for construction and loading of power plant prior to commencement of amortization are allowed for. Estimated costs under straight line amortization show the maximum annual charges with State development. A 4 per cent sinking fund amortization is included in the table in order to set forth the approximate average annual cost during the forty-year amortization period. The estimate, excluding amortization, sets forth the cost

TABLE 8

Estimated Annual Cost Kennett Reservoir and Power Plant

Division	Capital	Plan 1 Private development: Including state and federal taxes (based on average tax rate)	Plan 1 Private development: Excluding state tax	Plan 2 State development of reservoir and dam. Private development of power plant: *Straight line amortization of state bonds, state taxes included	Plan 2 State development of reservoir and dam. Private development of power plant: Sinking fund amortization of state bonds, state taxes excluded	Plan 3 State development of reservoir, dam and power plant: *Straight line amortization of bonds	Plan 3 State development of reservoir, dam and power plant: Sinking fund amortization of bonds	Plan 3 State development of reservoir, dam and power plant: Excluding amortization of bonds
Reservoir and dam	$53,000,000							
Interest or return		$3,975,000	$3,975,000	$2,385,000	$2,385,000	$2,385,000	$2,385,000	$2,385,000
Amortization				1,325,000	556,000	1,325,000	556,000	
Depreciation		90,000	90,000	90,000	90,000	90,000	90,000	90,000
State tax		407,000						
Federal tax		212,000	212,000					
Operation and maintenance		200,000	200,000	200,000	200,000	200,000	200,000	200,000
Totals, reservoir and dam		$4,884,000	$4,477,000	$4,000,000	$3,231,000	$4,000,000	$3,231,000	$2,675,000
Power plant	17,000,000							
Interest or return		$1,275,000	$1,275,000	$1,275,000	$1,275,000	$765,000	$765,000	$765,000
Amortization						425,000	178,000	
Depreciation		111,000	111,000	111,000	111,000	178,000	178,000	178,000
State tax		229,000		229,000				
Federal tax		68,000	68,000	68,000	68,000			
Operation and maintenance		300,000	300,000	300,000	300,000	300,000	300,000	300,000
Totals, power plant		$1,983,000	$1,754,000	$1,983,000	$1,754,000	$1,668,000	$1,421,000	$1,243,000
Reservoir, dam and power plant:								
Interest or return		$5,250,000	$5,250,000	$3,660,000	$3,660,000	$3,150,000	$3,150,000	$3,150,000
Amortization				1,325,000	556,000	1,750,000	734,000	
Depreciation		201,000	201,000	201,000	201,000	268,000	268,000	268,000
State tax		636,000		229,000				
Federal tax		280,000	280,000	68,000	68,000			
Operation and maintenance		500,000	500,000	500,000	500,000	500,000	500,000	500,000
Totals, reservoir, dam and power plant	$70,000,000	$6,867,000	$6,231,000	$5,983,000	$4,985,000	$5,668,000	$4,652,000	$3,918,000
Total cost in per cent of capital		9.81	8.90	8.55	7.12	8.10	6.65	5.60
Total cost per kilowatt hour produced	1,217,600,000 kwh.	$0.00564	$0.00512	$0.00491	$0.00409	$0.00466	$0.00382	$0.00322

* Estimated costs under straight line amortization represent maximum money requirements which occur in first year of amortization period

during the first years; also the estimated carrying cost of the development, excluding retirement of capital.

The length of bond amortization might be increased to a sixty or sixty-five year period under the legal limitation and thus reduce the annual outlay. The table, however, indicates the limits between which the results, based on other assumptions, will fall. No depreciation has been assumed on lands or improvements removed. A minimum of 0.3 per cent has been included on the dam and appurtenances to cover contingencies and minor replacements. Depreciation on the power plant is estimated on forty years' life on a 6 per cent sinking fund for private and 4 per cent sinking fund for State ownership.

Operating and maintenance expenses are estimated to cover not only local but also general expenses and are somewhat higher than a study of expenses of the larger developments of the State would indicate in order to cover possible contingencies.

The table sets forth the estimated cost under private ownership of capital with and without State taxes. Under the present method of taxing electric utilities a private utility would pay the same State tax were it to purchase the power wholesale from the State as it would if the plant were constructed and owned by it, the tax being determined as a per cent of the total gross revenue of the utility. For comparison with costs of other power, therefore, the cost has been estimated excluding State taxes. The present State tax rate is 7.5 per cent of the gross revenue. Assuming revenue would equal total cost the resultant tax rate would be seventy-two hundredths of 1 per cent of the capital under Plan 1. This basis can hardly be expected to continue indefinitely. The rate of 1.35 per cent of capital is based on the average tax rate on general property now existing over the State equated to a per cent of capital cost. No State tax is estimated on the capital representing lands and improvements as the greater part of this cost represents cost of relocation of the railroad and highway and would not represent power company property.

COST OF TRANSMISSION.

Plan 4 contemplates construction and operation of trunk transmission lines to the important load centers of northern California, power to be wholesaled to political subdivisions and private utilities.

As indicated in Plate II and Tables 2, 3-A and 3-B, over 65 per cent of the market is located within a radius of 50 miles of San Francisco. From Table 1, it is to be noted that at present 94 per cent of the power is served directly by two companies. Further data show that within the Sacramento Valley and the San Francisco Bay region less than 2 per cent of the power is distributed by municipal systems, only one individual system distributing over 0.5 of 1 per cent of the existing load. These systems are scattered from Redding on the north to Santa Clara on the south. This does not include the Modesto and Turlock districts which produce their own power and would require only standby service.

Transmission of such a large amount of power as Kennett output will require as a minimum, a double circuit 220,000 volt transmission line to the main load center in the Bay district.

It is apparent from an engineering consideration of the data that outside of the two main companies there are at present no municipal

or private resale systems of sufficient size or advantageous location to take power economically from the main trunk transmission line. Should another system develop which could avail itself of the purchase of power wholesale it must be assumed that the revenue to be received would justify the added capital expenditure. At present only two agencies of sufficient size to utilize the output of Kennett exist: one, the Pacific Gas and Electric Company; the other, the Great Western Power Company of California. If transmission of power by the State is contemplated the logical terminal of the transmission line would be in the general vicinity of Antioch, Contra Costa County, practically two hundred miles' transmission distance from Kennett. Both companies have important substations and transmission lines in this location which is near the center of load.

The cost of transmission per kilowatt hour will vary materially, depending on the plan of operation and whether adequate standby service against interruption is contemplated. By wholesaling the output to these two agencies the cost to the State will be reduced to a minimum. Under such delivery the transmission line can be limited to two circuits and one substation as the purchasing systems with their steam-electric and hydro-electric plants and extensive transmission networks will be adequate in size to take care of interruptions without detriment to the public service.

If the State contemplates delivery of power comparable in continuity to that now delivered by existing utilities an additional transmission line and steam-electric standby plant would be required in excess of that herein estimated.

Table 9 sets forth the estimated investment and annual cost to the State and to a private utility to transmit Kennett power to the load center wholesaling it to the existing agencies. This represents the minimum capital and annual cost requirements for transmission.

TABLE 9

Cost of Transmission of Kennett Power, Kennett to Antioch

Investment Cost

Transmission line—200 miles double circuit tower line	$6,000,000
Receiving substation, 200,000 kilowatt capacity	3,600,000
Total	$9,600,000

Power delivered 88% of 1,217,600,000 kilowatt hours = 1,070,000,000 kilowatt hours.

Basis of Annual Cost

Per cent of Capital

	State development		
	Straight line amortization	*Sinking fund amortization*	*Private development*
Interest or return	4.5	4.5	7.50
Amortization—40 years	2.5	1.05	-----
Depreciation	1.35	1.35	1.00
Maintenance and operating expense, including general expense:			
Transmission line	.75	.75	.75
Terminal substation	2.50	2.50	2.50
Taxes, state and federal	---	---	1.75

Annual Cost

1. Transmission line:			
Interest on $6,000,000	$270,000	$270,000	$450,000
Amortization	150,000	63,000	-----
Depreciation	81,000	81,000	60,000
Maintenance and operating expense	45,000	45,000	45,000
Taxes	-----	-----	105,000
Total cost of transmission to substations	$546,000	$459,000	$660,000

2. Receiving substation:			
Interest on $3,600,000	$162,000	$162,000	$270,000
Amortization	90,000	37,800	----
Depreciation	48,500	48,500	36,000
Operating expense	90,000	90,000	90,000
Taxes	------	-------	63,000
Total cost of receiving substation	$390,500	$338,300	$459,000
3. (a) Total cost of transmission	$936,500	$784,300	$1,119,000
(b) Total cost of transmission, excluding state taxes	-------	------	989,600
4. Cost per kilowatt hour delivered, a	$0.000875	$0.000733	$0.001044
b	------	------	0.000924

From Tables 8 and 9, the total cost to the State under Plan 4, assuming the wholesaling of power to the existing agencies, may be summarized as follows:

		Annual cost	
	Capital cost	*Straight line amortization of bonds—40 years*	*Sinking fund amortization of bonds—40 years*
1. Dam, reservoir and power plant	$70,000,000	$5,668,000	$4,652,000
2. Cost per kilowatt hour produced—(1,217,600,000 kilowatt hours)	----------	($0.00466)	($0.00382)
3. Transmission line and substation	9,600,000	936,500	784,300
4. Totals	$79,600,000	$6,604,500	$5,436,300
5. Total cost per kilowatt hour delivered from terminal substation—(1,070,000,000 kilowatt hours)	----------	($0.00617)	($0.00508)

In the above table and in Table 9, preceding, the figures under straight line amortization represent the maximum costs which occur during the first year of the amortization period.

VALUE OF POWER OUTPUT

The value of the power output of Kennett and the revenue from the power under Plans 1, 2, 3 and 4 will depend upon the characteristics of the output and upon the cost of power from other and competitive sources. Power that is available mainly in spring months or in wet years is less valuable, requiring more auxiliary steam-electric power installation than power which can be depended upon under adverse conditions of drought. Plate VII, heretofore referred to, sets forth graphically the estimated annual and monthly variation of power from Kennett compared with other hydro-electric plants of northern California. This comparison shows that Kennett power under the conditions of operation specified has better characteristics than the power from other plants.

There are three measures of the value of power, based upon cost of power from other sources:

1. Cost of power from other hydro-electric plants.
2. Cost of power from steam-electric plants.
3. Wholesale price for power as indicated by existing contracts.

Throughout this analysis comparison will be made on a unit basis of mills per kilowatt hour. Such a basis is only correct where power characteristics and point of delivery are equivalent. These units are better understood, however, and will be used with qualifying statements.

COST OF POWER FROM OTHER HYDRO-ELECTRIC PLANTS

The potential water power resources of California have been inventoried and summarized by Mr. F. E. Bonner of the Federal Power Commission, in a report just issued by that commission. Table 10, compiled from Table 9 of the Bonner Report, shows the present and principal ultimate development of the water power resources of the State. This shows by main streams the present and estimated ultimate installed capacity and output in average kilowatts, and ultimate output in millions of kilowatt hours. Although these figures are not directly comparable with estimates of kilowatt hours and plant capacities shown in other portions of this report, they are indicative of the extent of the present development, the potential development and the main source of future production of power in California from hydro-electric sources. It is to be noted from the table that 70 per cent of the potential hydro-electric power of California exists on streams north of Merced and tributary to northern California, and only 30 per cent in the territory tributary to southern California. Present development in the north is only 14 per cent of the total potential and indicates that for a long period undeveloped resources will exist.

The important streams of northern California are the Klamath; the Pit, McCloud and Sacramento group; the Feather and the American rivers. The important streams tributary to southern California are the San Joaquin and Kings. In view of the relative proximity of the Pit and Feather rivers to the Kennett development, the cost of power

TABLE 10. Summary of Water-power Resources of California

From Table 9, "Report to Federal Power Commission on the Water Powers of California," by Frank E. Bonner

Drainage basin	Existing development: No. plants	Existing development: Installed capacity, kw.	Existing development: Output average, kw.	Ultimate development [a]: No. plants	Ultimate development [a]: Installed capacity, kw.	Ultimate development [a]: Output average, kw.	Ultimate development [a]: Output, millions of kwh.	Per cent of group	Per cent of state
Northern group:									
1. Smith River	---	---	---	---	---	---	---	---	
2. Klamath River [b]	4	56,200	27,170	17	808,200	508,881	4,457.8	15.9	
3. Trinity River	3	2,775	800	12	303,000	180,925	1,584.9	5.7	
4. Eel River	1	6,800	5,700	2	11,000	8,800	77.1	.3	
5. Pit River	4	120,500	89,964	11	480,500	316,346	2,771.2	9.9	
6. McCloud River	---	---	---	4	221,500	133,705	1,171.3	4.2	
7. Sacramento River	6	37,000	19,097	9	469,000	257,647	2,257.0	8.1	
Totals (5–7, inclusive)	10	157,500	109,061	24	1,171,000	707,698	6,199.5	22.2	
8. Deer and Mill creeks	---	---	---	2	60,000	45,000	394.2	1.4	
9. West Fork Feather and Butte Creek	4	22,400	13,863	4	22,400	13,863	121.4	.4	
10. Feather River	4	175,800	105,023	24	1,065,800	698,251	6,116.7	21.8	
11. Yuba River (including Bear River)	9	114,375	74,200	18	389,675	251,707	2,205.0	7.9	
12. American River	3	29,000	14,270	22	546,000	317,408	2,780.5	9.9	
13. Mokelumne River	1	19,400	7,954	6	138,000	94,405	827.0	3.0	
14. Stanislaus River	7	73,200	31,393	16	293,700	207,680	1,819.3	6.5	
15. Tuolumne River	4	117,600	73,400	8	241,300	160,743	1,408.1	5.0	
Totals (1–15, inclusive)	50	775,050	462,834	155	5,050,075	3,195,861	27,991.5	100.0	70.5
Per cent of ultimate development	---	---	14	---	---	100	---	---	
Southern group:									
16. Merced River	6	34,150	15,810	12	93,650	47,541	416.4	3.5	
17. San Joaquin River	11	404,300	251,142	24	960,100	524,667	4,596.1	39.0	
18. Kings River	1	31,500	13,700	15	609,000	407,750	3,571.9	30.3	
19. Kaweah River	3	6,700	4,727	3	6,700	4,727	41.4	.3	
20. Tule River	2	7,500	4,205	2	7,500	5,791	50.7	.4	
21. Kern River	4	76,500	52,209	9	198,500	119,952	1,050.8	8.9	
22. Truckee River [c]	1	1,650	596	3	7,500	5,000	43.8	.4	
23. Carson River	---	---	---	1	6,000	4,000	35.0	.3	
24. Walker River	1	500	300	2	15,500	9,400	82.3	.7	
25. Mono Lake	4	25,000	8,380	3	24,100	7,582	66.4	.5	
26. Bishop Creek	5	24,475	13,927	6	27,575	17,124	150.0	1.3	
27. Owens River	12	103,320	34,246	20	244,860	162,564	1,424.1	12.1	
28. Santa Clara River	---	---	---	3	23,000	8,000	70.1	.6	
29. San Gabriel River	1	2,000	1,152	1	2,000	1,152	10.1	.1	
30. Santa Ana River	11	15,475	10,062	15	29,675	18,462	161.7	1.4	
31. Salton Sea	3	3,030	1,255	5	5,830	2,295	20.1	.2	
32. San Diego County	2	800	400	2	800	400	3.5	.0	
33. Miscellaneous	1 [d]	950	350	1	950	350	3.1	.0	
Totals (16–33, inclusive)	68	737,850	412,461	127	2,263,240	1,346,757	11,797.5	100.0	29.5
Per cent of ultimate development	---	---	31	---	---	100	---	---	
Total State (1–33, inclusive)	118	1,512,900	875,295	282	7,313,315	4,542,118	39,788.0	.....	100.0

[a] Including existing developments.
[b] Excluding part in Oregon.
[c] Excluding part in Nevada.
[d] Swanton Plant, Santa Cruz County.

TABLE 11

Estimated Cost of Hydro-Electric Power from Present and Future Pit and Feather River Developments

	Pit River developments		*Feather River developments*	
	Pacific Gas and Electric Company		*Great Western Power Company*	
	Present	*Future*	*Present*	*Future*
1. Plants included	Pit 1 and 3 Hat Creek 1 and 2	Pit 2, 4, 5 and 6	Caribou and Las Plumas	Plants 1–8b
2 Plant capacity	176,000 kva.	806,000 kva.	135,000 kw.	593,750 kw.
3. Average annual output	828 million kwh.	1,583 million kwh.	870 million kwh.	3,430 million kwh.
4. Investment cost	$23,233,000	$40,100,000	$29,300,000	$105,704,000
5. Basis of computing annual cost:				*Per cent of capital*
Return				7.5
Depreciation				0.65
Operating, maintenance and general expense				0.75
Taxes:				
Federal				.40
State				1.35
Total				10.65
6 Total annual cost:				
(a) Including state tax	$2,474,315	$4,270,650	$3,120,450	$11,257,476
(b) Excluding state tax	2,160,669	3,729,300	2,724,900	9,830,472
7 Cost per kwh. average output:				
(a) Including state tax	$0.00299	$0.00270	$0.00359	$0.00328
(b) Excluding state tax	$0.00261	$0.00236	$0.00314	$0.00287

from the present and future developments on these streams will indicate fairly closely the cost of power from other hydro-electric sources competitive with Kennett. These streams are being developed by the two major agencies serving northern California, namely the Pacific Gas and Electric Company and the Great Western Power Company, and are the probable sources of the main development during the next ten years or more.

Table 11 sets forth the estimated cost of power from the present developments and the estimated cost of power from future developments contemplated on the Pit and Feather rivers by the Pacific Gas and Electric Company and the Great Western Power Company, respectively. The cost of electric power from existing plants is based upon the actual costs or estimated costs of the projects under present price levels. The cost for future plants is based on tentative estimates heretofore prepared by these companies. The costs with and without State taxes are shown for the reasons heretofore set forth.

The characteristics of power from the present Pit River development compared with Kennett are shown in Plate VII. The locations of the present developments on Pit River are approximately forty miles further from the power market than Kennett. This results in a differential in favor of Kennett of approximtaely two-tenths mills per kilowatt hour.

The characteristics of the power now being produced by the existing plants on the Feather River and that which may be produced by future plants are in general closely comparable with the primary or dry year output of Kennett development; that is, the minimum output of 990,400,000 kilowatt hours, per year. This greater dependability has been made possible by the large cyclic storage of water in Lake Almanor at the upper end of the series of plants.

It is to be noted from the table that the estimated cost including taxes for the present Pit development is approximately three mills per kilowatt hour and for the future development, two and seven-tenths mills, while the cost of power from the Feather River approximates three and six-tenths mills for present plants and three and three-tenths mills per kilowatt hour for future plants. These plants are 100 miles nearer the main power market than the Pit plants and the characteristics of power are better. If weight be given to these factors and the value of power measured at the load center near San Francisco Bay, the two sources of power are practically of equal value per kilowatt hour.

There are other potential developments of power, as indicated in Table 10 on the Klamath and south of the Feather River. Klamath, being approximately 90 miles further from the market, is subject to a differential in favor of Kennett of from four-tenths to five-tenths mills per kilowatt hour. The developments south of Feather River are in general at least 100 miles nearer the center of the power market than Kennett and therefore have a differential in their favor of from five-tenths to seventy-five hundredths mills per kilowatt hour, this differential including cost of transmission and shrinkage of kilowatt hours due to transmission losses.

The San Joaquin Valley power market depends upon the San Joaquin and Kings rivers mainly for hydro-electric power. The cost of

power from these streams is estimated at three to five mills per kilowatt hour of average annual output. The distance from Kennett to the market in the San Joaquin Valley is from 300 to 450 miles. Generally transmission of power in excess of 300 miles has not been justified. The differential for transmission from Kennett would be at least two mills per kilowatt hour which, deducted from an average cost of four mills would leave two mills or less per kilowatt hour for power at Kennett.

The potential power available from the main streams of northern California which may be economically developed would indicate that until this is utilized the value of Kennett power measured by competition with other hydro-electric sources would be between two and seven-tenths and three and three-tenths mills per kilowatt hour. As the more economical sources are used the value compared with other hydro-electric sources may tend to increase.

VALUE OF KENNETT POWER DETERMINED FROM COST OF POWER FROM STEAM-ELECTRIC PLANTS

COST OF STEAM-ELECTRIC POWER.

There has been during the last several years a marked increase in efficiency of steam-electric production. A still further improvement in efficiency may be expected. On the basis of 60 per cent plant load factor with present efficiencies the fuel requirements are 15,000 British thermal units or less per kilowatt hour produced. It appears from study of literature on the subject and from present trend of efficiency that reduction of the requirement to below 14,000 British thermal units may be expected in the near future and later as low as 12,000 British thermal units per kilowatt hour.

The question of price of oil is impossible of determination for any period of time. The present price is $1 per barrel. The price has fluctuated widely in the past. When the present condition of overproduction of oil is past, increase in price may be expected. Coal supply would indicate a limitation in fuel cost, however, to approximately the equivalent of $1.50 per barrel of oil.

Table 12 sets forth the estimated cost of power from a steam-electric plant operating at 60 per cent load factor to supply a load necessary to absorb fully the potential output of Kennett. The conditions of efficiency are those that should be obtained by new plants in the next few years. Oil has been estimated at $1 per barrel. The cost of power from recently constructed plants would, on a basis of $1 per barrel for oil, be two-tenths mills per kilowatt higher. Table 13 sets forth the estimated cost based on probable further efficiency development and price of oil of $1.25 per barrel.

It is to be noted that the cost of steam-electric power is divisible into two parts; one fixed and amounting to approximately $17 or $15.50 per kilowatt of capacity, depending upon treatment of taxes, and on output cost varying with the power produced from two to two and twenty-three hundredths mills per kilowatt hour.

EQUIVALENT VALUE OF HYDRO-ELECTRIC POWER.

A determination of the relative value of hydro-electric power by comparison with the cost of steam-electric power requires special care to insure equivalent bases, owing to market difference in fundamental characteristics of output and variation in costs between the two sources. The output of hydro-electric plants such as Kennett varies from year to year, depending upon conditions of precipitation. Costs are practically fixed and do not vary with output or with price of fuel. Steam-electric power output can be readily adjusted to demands, a considerable part of the cost varying directly with the output and the price of fuel. The determination of relative value has been made by load characteristics similar to those of northern California and sufficient to absorb the output of Kennett without wastage. This cost has then been compared with cost of power from Kennett with necessary auxiliary steam-electric power.

TABLE 12

Estimated Cost of Steam-Electric Power Basis of Probable Efficiency of Immediate Future

	Basis	
1. Steam-electric power installation to supply load equivalent to Kennett plus steam-electric auxiliary:		
(a) Annual production	1,275,000,000	kilowatt hours
(b) Capacity for 60% load factor, 243,000 kilowatts, use	250,000	kilowatt capacity
(c) Cost of power plant and connecting transmission line at $110 per kilowatt	$27,500,000	
2. Estimated efficiency: 1 bbl. of oil per kilowatt per year plus 1/500 bbl. of oil per kilowatt hour net output.		
3. Annual cost:		
(a) Return on investment	7.5%	
(b) Depreciation	2.25%	
(c) Operating expenses other than oil	$3.00 per kilowatt year	
(d) General expense	3% of cost other than oil and taxes	
(e) Oil	$1.00 per bbl.	
(f) Tax: State 1.35%		
Federal .40		
	1.75%	
4. Annual cost:		
(a) Fixed costs:		
Return at 7.5%	$2,062,500	
Depreciation at 2.25%	618,750	
Operating expense at $3	750,000	
General expenses	102,940	
Standby oil at $1	250,000	
Taxes at 1.75%	481,250	
Total fixed costs	$4,265,440	
(b) Output costs:		
Oil at $.002 per kilowatt hour	2,550,000	
(c) Total costs	$6,815,440	

	(a) *Including state tax*	(b) *Excluding state tax*
5. Unit costs:		
Demand or fixed cost per kilowatt of capacity	$17.06	$15.57
Energy cost per kilowatt hour of output	.002	.002
6. Average cost per kilowatt hour	.00535	.00527

The steam-electric plant would be located on San Francisco Bay and as to relative distance to the market, would be equivalent to the terminal substation of Kennett transmission.

The cost of steam-electric power based on the estimates in Table 12 have been set up in Table 14 (Item "C"). From this has been deducted the annual cost of the auxiliary steam-electric plant required to supply the load without wastage of power from Kennett in years of maximum output. The balance (Item E-10) represents the relative value of Kennett Power delivered at Antioch. Deducting the cost of transmission the relative value of Kennett power at the plant is determined.

TABLE 13

Estimated Cost of Steam-Electric Power Basis of Probable Efficiency Future

	Basis	
1. Steam-electric power installation to supply load equivalent to Kennett plus steam-electric auxiliary:		
(a) Annual production	1,275,000,000	kilowatt hours
(b) Capacity for 60% load factor, 243,000 kilowatts, use	250,000	kilowatt capacity
(c) Cost of power plant and connecting transmission line at $110 per kilowatt	$27,500,000	
2. Estimated efficiency: 75 bbl. of oil per kilowatt per year plus 1/560 bbl. of oil per kilowatt hour net output.		
3. Annual cost:		
(a) Return on investment		7.5%
(b) Depreciation		2.25%
(c) Operating expenses other than oil		$3.00 per kilowatt year
(d) General expense		3% of cost other than oil and taxes
(e) Oil		$1.25 per bbl.
(f) Tax: State 1.35% Federal .40		1.75%

4. Annual cost:	
(a) Fixed costs:	
Return at 7.5%	$2,062,500
Depreciation at 2.25%	618,750
Operating expense at $3	750,000
General expenses	102,940
Standby oil at $1.25	234,000
Taxes at 1.75%	481,250
Total fixed costs	$4,249,440
(b) Output costs:	
Oil at $.002 per kilowatt hour	2,843,325
(c) Total costs	$7,092,765

5. Unit costs:	(a) *Including state tax*	(b) *Excluding state tax*
Demand or fixed cost per kilowatt of capacity	$17.00	$15.58
Energy cost per kilowatt hour of output	.00223	.00223
6. Average cost per kilowatt hour	.00556	.00527

TABLE 14

Comparison of Value of Kennett Power With Steam-Electric Produced Power

			Including tax	*Excluding tax*
A. Kennett development 220,000 kilowatts—275,000 kilovolt-amperes.				
1. Output of Kennett plant annual average			1,217,600,000 kwh.	
2. Delivery from terminal substation			1,070,000,000 kwh.	
3. Steam-electric auxiliary plant output required to supply load that will absorb Kennett output without wastage			205,000,000 kwh.	
4. Total output basis of terminal delivery			1,275,000,000 kwh.	
5. Steam-electric auxiliary capacity required based on maximum monthly requirement 80% load factor			62,500 kw.	
B. Steam-electric power equivalent.				
6. Steam-electric plant capacity to supply load on 60% load factor basis 243,000 kw., use			250,000 kw.	
C. Steam-electric plant costs.				
7. Demand charge unit cost			$17.00	$15.50
8. Demand cost	250,000 kw.		$4,250,000	$3,875,000
Energy cost	1,275,000,000 kwh.		2,550,000	2,550,000
Totals			$6,800,000	$6,425,000
Per kilowatt hour delivered			.00533	.00504
D. Auxiliary steam-electric cost.				
9. Demand cost	62,500 kw.		$1,062,000	$968,750
Energy cost	205,000,000 kwh.		410,000	410,000
Totals			$1,472,000	$1,378,750
E. Value of hydro-electric power at substation terminals.				
10. Available for hydro-electric power from transmission (8)–(9)			$5,328,000	$5,046,250
Per kilowatt hour delivered (1,070,000,000 kwh.)			.00498	.00471
11. Transmission cost			$1,119,000	$989,600
F. Value of hydro-electric power at Kennett			$4,209,000	$4,056,650
12. Value per kilowatt hour (1,217,600,000 kwh.)			.00347	.00334
13. Value per kilowatt hour based on future steam plant efficiency and oil at $1.25 per bbl.			.00368	.00355

Similar comparison has been made of the relative value of Pit power now developed. This computation is shown in Table 15. The difference of two-tenths mill per kilowatt hour in the unit values between Kennett and Pit is accounted for mainly by the greater transmission distance to Pit plants.

TABLE 15

Comparative Value of Pit Power With Steam-Electric Produced Power

A. Pit development 141,600 kilowatts.			
1. Output of Pit developments, annual average			828,000,000 kwh.
2. Delivery from terminal substation, 14% transmission loss			713,000,000 kwh.
3. Steam-electric auxiliary plant output required to supply load that will absorb Pit output without wastage			387,000,000 kwh.
4. Total output based on terminal delivery			1,100,000,000 kwh.
5. Steam auxiliary capacity required based on maximum monthly requirements 80% load factor			92,500 kw.
B. Steam-electric power equivalent.			
6. Steam plant capacity to supply load on 60% load factor basis 209,000 kilowatts use			215,000 kw.
C. Steam-electric plant costs.		*Including tax*	*Excluding tax*
7. Unit demand cost		$17.00	$15.50
8. Demand cost	215,000 kw.	$3,655,000	$3,332,500
Energy cost	1,100,000,000 kwh.	2,200,000	2,200,000
Totals		$5,855,000	$5,532,500
Per kilowatt hour delivered		.00533	.00505
D. Auxiliary steam-electric cost.			
9. Demand	92,500 kw.	$1,572,500	$1,433,400
Energy	387,000,000 kwh.	774,000	774,000
Totals		$2,346,500	$2,207,400
E. Value of hydro-electric power at substation terminals.			
10. Available for hydro-electric power from transmission (8)–(9)		$3,508,500	$3,325,100
Per kilowatt hour delivered (713,000,000 kwh.)		.00493	.00467
11. Transmission cost		$845,000	$733,000
F. Value of hydro-electric power at Pit plants		$2,663,500	$2,592,100
12. Value per kilowatt hour (828,000,000 kwh.)		.00322	.00313
13. Value based on future steam-electric plant efficiency and oil at $1.25 per bbl		.00342	.00333

The value of Kennett power measured at the power plant, determined from comparison with steam-electric power, is between three and thirty-four hundredths and three and sixty-eight hundredths mills per kilowatt hour based on the prices of oil considered.

MARKET PRICE OF POWER AS DETERMINED FROM EXISTING CONTRACTS

There exists at the present time in the northern and central parts of the State, six main contracts covering the purchase by utilities of the output of hydro-electric plants constructed by irrigation districts, municipalities or other public utilities. These contracts and purchases involve the following:

1. Merced Irrigation District and San Joaquin Light and Power Corporation.
2. Turlock Irrigation District and San Joaquin Light and Power Corporation.
3. South San Joaquin and Oakdale Irrigation Districts and Pacific Gas and Electric Company.
4. City of San Francisco and Pacific Gas and Electric Company.
5. Feather River Power Company and Great Western Power Company of California.
6. California Oregon Power Company and Pacific Gas and Electric Company.

These contracts, in total, involve the delivery of approximately the amount of power to be produced at the Kennett development.

There are two other contracts not readily comparable which have not been included but, in so far as can be ascertained, indicate somewhat lower prices than the six contracts considered.

1. Merced Irrigation District and San Joaquin Light and Power Corporation.

This contract involves delivery of power at the high tension terminal of the power plant on the Merced River. The power is seasonal in character and the output fluctuates between wide limits from wet to dry years. The contract was entered into when costs of construction and competitive costs of power were higher than at the present time. The price is four and five-tenths mills per kilowatt hour and delivery is approximately fifty miles from a point which may be considered equivalent to Bay district delivery of Kennett power.

2. Turlock Irrigation District and San Joaquin Light and Power Corporation.

This contract provides for delivery at Livingston or Merced Falls of the surplus power of the Turlock Irrigation District. Obligation to purchase is maximum from June to December and reduced during the months of January to May. The price is four and five-tenths mills per kilowatt hour. Delivery is practically equivalent in location to Merced District delivery.

3. South San Joaquin and Oakdale Irrigation Districts and Pacific Gas and Electric Company.

In this case the dam and reservoir were constructed by the Districts, the power company constructed the power plant and in addition to its own costs pays to the Districts for a period of forty years an amount equal to interest and amortization on the Districts' capital. The cost, including estimated State tax based upon power plant output, is approximately four and two-tenths mills per kilowatt hour. The contract provides, however, that after the forty-year period the power company

is obligated to pay to the districts only half of the operation and maintenance of the dam and reservoir and nothing in the way of return. The power is seasonal in character and involves fairly wide fluctuations between wet and dry years. Equivalent transmission distance is approximately 50 miles.

4. City of San Francisco and Pacific Gas and Electric Company.

This contract provides for delivery at Newark substation, which is comparable with delivery at Antioch, of the output of the Moccasin Creek plant at 75 per cent daily load factor. The power supply is dependable from the standpoint of variation from wet to dry years, but the contract provides for cancellation. This contract represents the largest power delivery and the nearest comparable with the delivery of power from Kennett reservoir to a point such as Antioch. The price is four and eight hundred seventy-eight thousandths plus mills per kilowatt hour.

5. Feather River Power Company and Great Western Power Company of California.

This contract provides for a delivery of 40,000 kilowatts at approximately 60 per cent annual load factor at the high tension terminals of the power plant transformers, a distance of 150 miles from the Bay area. The price is four mills per kilowatt hour, but the contract provides that at the end of thirty-five years the total power development of the Feather River Power Company will become the property of the Great Western Power Company. The purchase of property feature in the contract represents about twenty-five hundredths mills per kilowatt hour.

6. The California Oregon Power Company and Pacific Gas and Electric Company.

The agreements between these companies call for 30,000 kilowatts delivery at 70 per cent load factor, measurement at Cottonwood substation of the Pacific Gas and Electric Company, but provide that the purchasing company will construct a part of the transmission line between the California Oregon Power Company plants and Cottonwood substation. The price for power at 70 per cent load factor or less is four and five-tenths mills per kilowatt hour. The point of delivery is comparable generally with delivery at Kennett power plant.

Table 16 sets forth certain statistics with reference to the six agreements, showing the approximate annual power delivery, the voltage and point of delivery, the relative characteristics of the power compared with Kennett power, the approximate distance to the general market comparable with the 200 miles transmission from Kennett to Antioch, the equivalent delivery, the price covered by the contract, this price equated to delivery equivalent to Antioch for Kennett power, and to delivery at Kennett. In the determination of the differential between the various prices actually paid for power and the equivalent price at Antioch and Kennett, transmission costs and losses have been estimated as proportional to relative transmission distance from the power market.

TABLE 16

Comparison of Contract Prices for Power Purchased from Hydro-electric Power Plant Developments

Company	Approximate amount of power purchased: Kw. peak	Kwh. annually	Equivalent delivery from transmission at market kwh. annually	Delivery: Voltage (nominal)	Delivery: Point	Power Characteristics (a)	Approximate distance to general market, miles	Contract period—years	Price per kwh. mills (at delivery point)	Cost of equivalent delivery from transmission, mills per kwh. delivered	Resultant prices comparable to Kennett delivery at power plant, mills per kwh. delivered
1. Merced Irrigation District and San Joaquin Light and Power Corporation	30,000	120,000,000	116,500,000	60,000	Power Plant	Seasonal 80% load factor 40%–130% annual variation (*)	50	20	4.5	4.9	3.39
2. Turlock Irrigation District and San Joaquin Light and Power Corporation	2,500 to 6,500†	40,000,000	38,500,000	60,000	Merced Falls and Livingston	Annual (‡)	50	15	4.5	4.9	3.39
3. South San Joaquin and Oakdale Irrigation districts and Pacific Gas and Electric Company (b)	25,000	100,000,000	97,000,000	60,000	Power Plant	Seasonal load factor not determined 62%–130% annual variation (*)	50	40	4.2	4.6	3.13
4. City of San Francisco and Pacific Gas and Electric Company	75,000	475,000,000	475,000,000	110,000	Newark Sub.	75% load factor practically no annual variation (†)	0	Subject to cancellation	4.378	4.378	3.37
5. Feather River Power Company and Great Western Power Company of California (c)	40,000	208,000,000	187,500,000	220,000	Power Plant	Annual 63% load factor (‡)	150	35	4.00	5.19	3.84
6. California-Oregon Power Company and Pacific Gas and Electric Company (d)	30,000	180,000,000	158,500,000	110,000	Near Delta measured at Cottonwood	Annual 70% load factor (‡)	200	25	4.5	6.17	4.50
Totals	201,500	1,123,000,000	1,073,000,000							4.96 (e)	3.45
7. Kennett Development	220,000	1,217,600,000	1,070,000,000	220,000	Power Plant	Annual 70% load factor 81.5%–108.2% annual variation	200				

(a) Seasonal indicates mainly spring and summer power.
"40%–130% annual variation" indicates variation in annual output wet and dry years.
(†) Indicates better than Kennett.
(‡) Indicates equal to Kennett.
(*) Less valuable than Kennett.

(b) Pacific Gas and Electric Company constructed and owns power plant. 4.2 mills = estimated cost, including taxes — amortization of district investment. Cost of amortization approximately 0.2 mills per kwh.

(c) Price covers amortization of investment in plant in 35 years. This equals approximately 0.24 mills per kwh.

(d) Major part of transmission capital already invested so that cost delivered not as great as 6.17 mills.

(e) Computed on basis of eliminating amortization referred to in (b) and (c) and ½ transmission cost of (d).

The purchase price for power from the California-Oregon Power Company is high, considered both from a standpoint of cost of hydro-electric power and in comparison with other contracts. At the time the contract was entered into, the Pacific Gas and Electric Company had excess transmission capacity from Cottonwood substation to Vaca-Dixon substation. It would still have this excess in lines from Vaca-Dixon to Antioch when completed for delivery of power to Antioch. For a part of the period of the contract, therefore, the added transmission cost of this power would be relatively small. This condition could not be applied to Kennett power, which in itself would require two transmission circuits. The Pacific Gas and Electric Company, however, could, by coordinating its transmission lines with those from Kennett, obtain some advantage over conditions under separate operation.

The purchases from the City of San Francisco, Feather River Power Company, the California-Oregon Power Company and the Turlock Irrigation District are equal to or slightly better than Kennett in quality of power. The total purchases under the contracts are practically equivalent in amount and in quality of power to Kennett power. With the adjustments for plant purchase in rates under certain contracts and for transmission capacity available in the case of the California-Oregon Power Company, the resultant value at Kennett is three and forty-five hundredths mills per kilowatt hour, and at Antioch four and ninety-six hundredths mills per kilowatt hour.

The above analysis indicates that from the standpoint of comparison with existing contracts for power, the value of electric power from Kennett under conditions of limited flood, salinity and irrigation operation would be three and forty-five hundredths mills per kilowatt hour at the power plant.

CONCLUSIONS RELATIVE TO VALUE OF KENNETT POWER OUTPUT

The value of Kennett electric power based upon the operation of the reservoir for limited flood and salinity control and irrigation, would appear from the foregoing to be approximately as follows:

Kennett delivery:	Mills per kilowatt hour
1. Based on other hydro-electric developments	2.7 to 3.3
2. Based on steam-electric costs as estimated	3.34 to 3.68
3. Based on existing contracts	3.45

From the present indications as to future economic conditions, the revenue that may be obtained from the sale of the electric power output of Kennett at the plant may not be expected to exceed $4,250,000 and at the terminal transmission near the Bay district not to exceed $5,300,000 per annum. Changes in economic conditions in the future may tend to increase or reduce these values.

RELATION OF REVENUE FROM POWER TO ANNUAL COST OF KENNETT DEVELOPMENT

Comparison of annual costs, as set forth in Table 8, with the estimated maximum revenue from power $4,250,000 per annum, indicates that this power revenue can be expected to meet State costs, excluding amortization, with a margin of safety of approximately 8.5 per cent, or $332,000. The annual cost under Plan 3, including 40-year sinking fund amortization, will exceed the power revenue, as estimated, by $402,000. Under Plan 2, with sinking fund amortization of State bonds and exclusion of State taxes, the annual cost will exceed the revenue, as estimated, by $735,000.

VALUE OF ELECTRIC POWER OUTPUT UNDER FULL CONTROL OF KENNETT RESERVOIR FOR IRRIGATION.

As heretofore referred to, analysis of the conditions under control for irrigation indicates that in the extreme the average annual output of the Kennett development will be reduced to about 770,000,000 kilowatt hours, varying from a minimum of 350,000,000 kilowatt hours, provided a minimum head on the power plant of 200 feet can be maintained, to somewhat over 1,000,000,000 kilowatt hours. The proportion of dependable power would be so reduced and the secondary power subjected to such wide fluctuation that the economic value of the composite output under present economic conditions would not exceed $2,000,000 per annum.

OTHER SOURCES OF REVENUE REQUIRED.

Power can not be expected, even under State financing, to carry much more than interest, depreciation and operating expenses of the Kennett development. Other sources of revenue such as State or Federal aid, sale of water for irrigation and payments by other beneficiaries will be required to cover amortization requirements under State financing. Greater aid would be required to carry the total cost in case of private development.

PLAN 3a

TRANSMISSION OF POWER BY PRIVATE COMPANIES AS COMMON CARRIERS

Plan 3a suggests that the State sell power at Kennett to individual municipalities or private resale companies and that the private companies purchasing the larger portion of the output be required under their contracts to transmit power as common carriers from Kennett for these municipalities and private companies.

The service to municipalities and private companies distributing electric energy requires extensive secondary transmission and substation systems in addition to the main trunk transmission lines considered herein; also steam-electric standby plants to insure against shortage of power in years of low precipitation and interruptions. The power requirements of such companies are at much lower load factors (between 30 and 45 per cent) than the estimated load factor of the Kennett output (70 per cent). If power were to be purchased for such service at Kennett the price per kilowatt hour, owing to the lower use per kilowatt of demand, would have to be materially higher than the average costs or values referred to under Plans 1, 2 and 3 herein. For the same reason transmission costs per kilowatt hour would be higher than the average. The costs or values per kilowatt hour heretofore referred to are not, therefore, indicative of what the charges would be for such deliveries at Kennett or of the total cost of the energy delivered to the individual municipalities. The rates now in effect for wholesale power on the systems of the existing agencies are low compared with the cost of power production and transmission on these systems. The cost of hydro-electric power from the present utilities is equal to or less than the price that could be paid wholesale for Kennett power. The State, therefore, would not receive any greater net return from such a plan than could be obtained under Plan 3.

PLAN 5

STATE DISTRIBUTION OF ELECTRIC POWER FROM KENNETT

Plan 5 contemplates State ownership of the power development, transmission lines, steam-electric standby plants and the necessary distribution system required to distribute the electric energy to the general public. This plan is a material departure from Plans 1 to 4, inclusive, and will require the investment of at least twice the capital.

It is important in considering Plan 5 that a clear perspective be had of the present and future conditions of service.

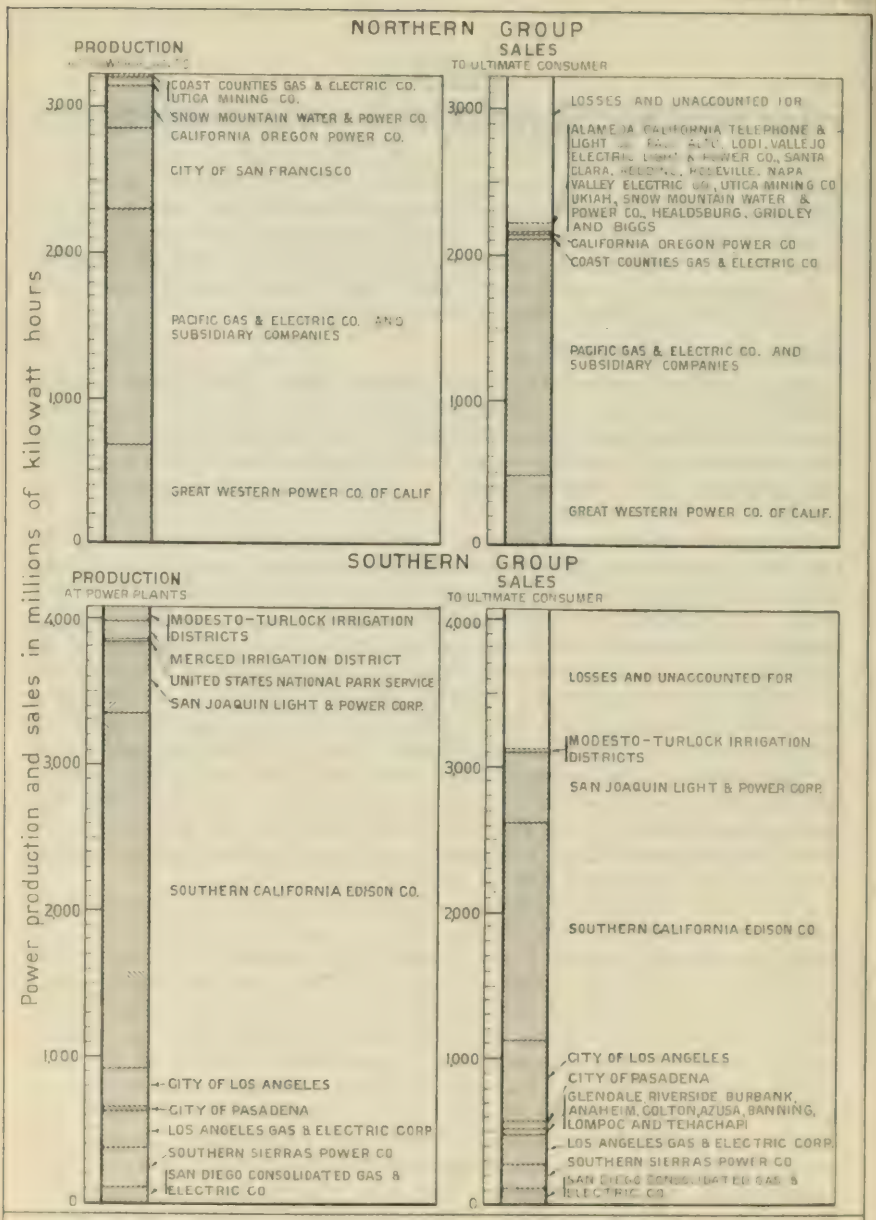
PRESENT DEVELOPMENT.

The past fifteen to twenty years of electric power development in the State have witnessed increasing consolidation of the electric utilities. Much of this has come about because of the possible economies from coordination and consolidation of the existing systems. This condition has developed to a greater extent in California than in many other states.

The market tributary to Kennett development is at present served by two main agencies supplying directly to the ultimate consumers 72 and 22 per cent, respectively, of the total load. At the time Kennett power would be available the entire market would be served by the existing agencies whose cost of power as far as production and transmission to the center of the market are concerned, is equal to or less than the cost that may be incurred by the State in the development of Kennett and no greater than the price the private utilities could pay for Kennett output in total. Plate VIII, "Electric Power Production and Sales by Companies in California, 1927," sets forth graphically the division of the market as indicated by production and sales by companies and political subdivisions for the northern and southern groups of the State for the year 1927. The relative extent of service by the various agencies in the northern part of the State is to be noted.

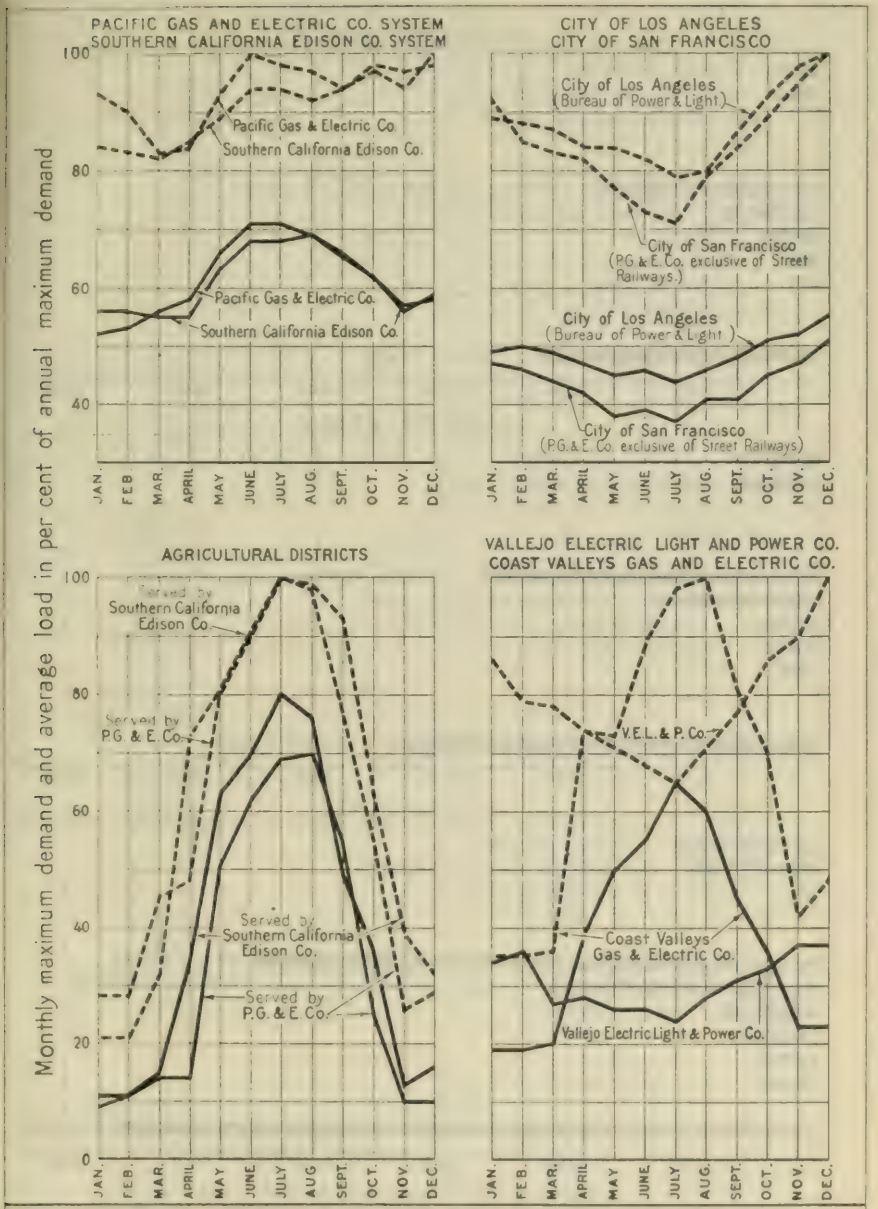
Plate IX, "Monthly Variation of Maximum Demand and Average Load for Typical Electric Power Systems in California, 1927," sets forth graphically some of the typical characteristics of the power demands of urban and rural territory. The upper right-hand chart indicates in percentage of the annual maximum requirement the variation in demand and energy requirements by months for two typical urban districts. The average use is approximately 45 to 50 per cent of the maximum demand and use is least in summer and greatest in winter. The lower left-hand chart gives characteristics of power for typical agricultural districts with their wide variation in demand and energy requirements, the maximum occurring generally in July, little requirement coming in winter. The lower right-hand chart indicates the wide variations between urban and rural power requirements. Compared with these characteristics for urban and rural power requirements is the upper left-hand chart giving similar characteristics of two of the most extensive electric systems of the State. This type of load is available to a development such as Kennett if its power were wholesaled to the existing agencies. Any one of the separate classes of service or districts could not supply a market which would readily

PLATE VIII.



ELECTRIC POWER PRODUCTION AND SALES
BY
COMPANIES AND POLITICAL SUBDIVISIONS
IN CALIFORNIA
1927

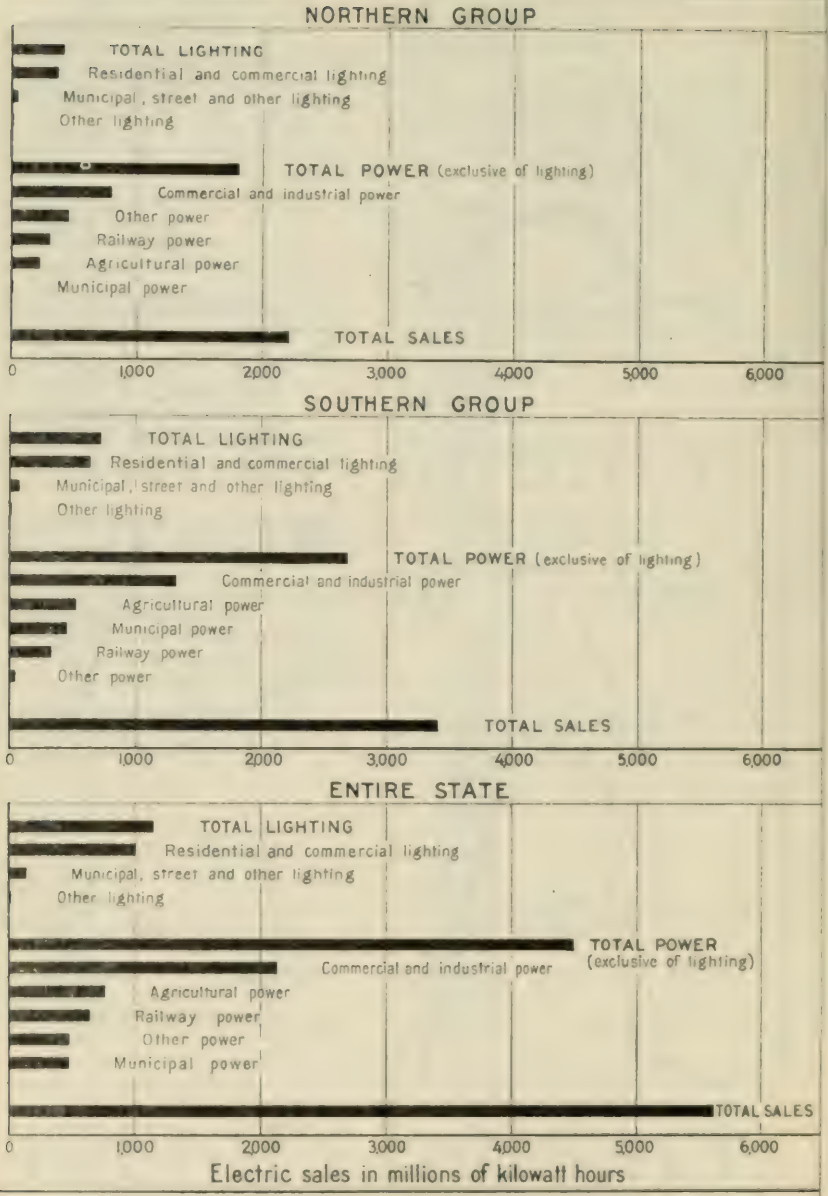
PLATE IX.



MONTHLY VARIATION OF MAXIMUM DEMAND AND AVERAGE LOAD FOR TYPICAL ELECTRIC POWER SYSTEMS IN CALIFORNIA 1927

---------- MAXIMUM DEMAND
———— AVERAGE LOAD

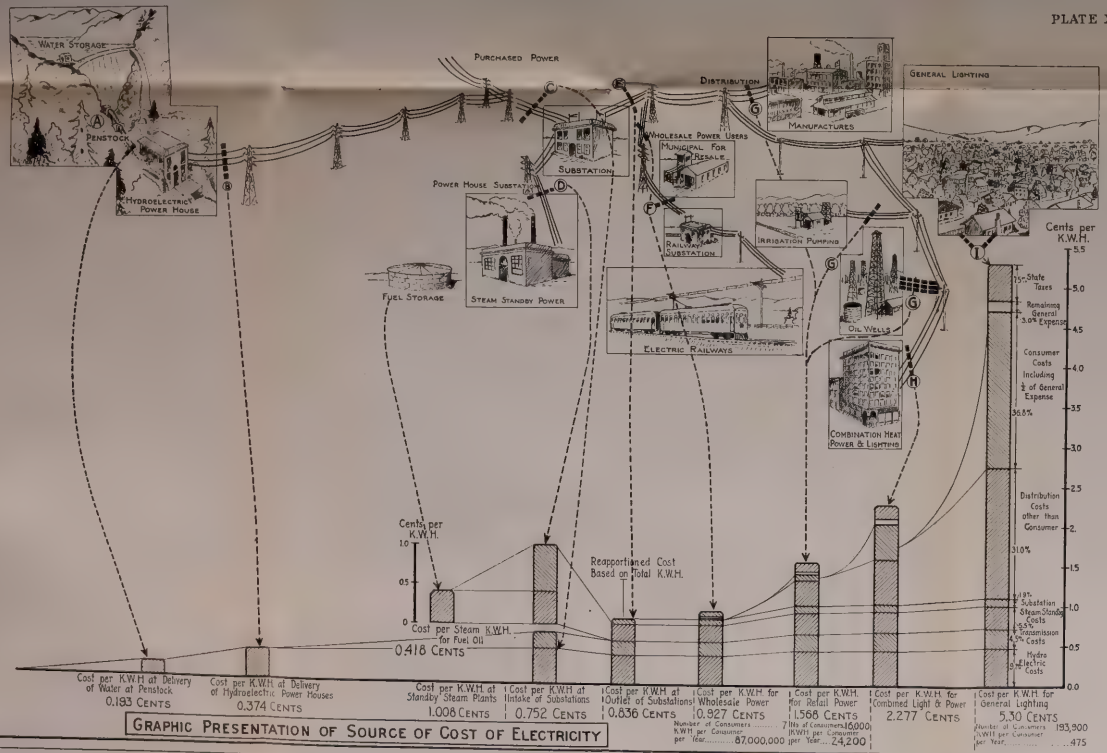
PLATE X



CLASSIFICATION OF ELECTRIC SALES

IN CALIFORNIA

1927



GRAPHIC PRESENTATION OF SOURCE OF COST OF ELECTRICITY

absorb Kennett output. If power were retailed, the State must obtain a load having characteristics similar to those indicated in Plate IX for the Pacific Gas and Electric Company, otherwise its cost of service would tend to be higher than the cost on the existing two main agencies serving the territory.

Plate X, "Classification of Electric Sales in California, 1927," sets forth the relative amount of energy used for lighting and for power in the northern and southern districts of the State and in the entire State. The percentage of lighting requirements in the urban districts is much greater than in the rural districts. It is the combination of a balanced proportion of the lighting and power service that makes possible the relatively high load factor in effect on the large systems.

BASIS OF PRESENT RATES.

The electric rates in California at present in effect are fixed to return to the utilities after all reasonable operating costs and allowances for depreciation are made an amount representing from 7 to 7.5 per cent upon the reasonable cost of used and useful property. The return resulting is available for the payment of fixed charges such as bond interest and dividends on stock. The return also covers compensation for any hazard in the business in the way of heavy losses, general depreciation of business, etc. Uniform rates for the several classes of service have been fixed over the larger systems and at present the rates are practically the same over the entire northern portion of the state, except residential and commercial lighting rates. Rates for these latter services are lower in the cities than in rural districts. The rates in general have been fixed, however, to give the developing and rural districts (especially agricultural service) the major portion of the advantage of the diversity of load characteristics between rural and city service. This basis of rates has materially assisted in the development of rural and agricultural districts, and of the State as a whole. It has been made possible only through ownership and operation by a few agencies of the production, transmission and, especially, distribution systems serving both districts. It has, however, resulted in somewhat higher earnings on local investment in congested and developed districts than on the average.

VARIATION IN COST OF ELECTRICITY.

Plate XI, "Graphic Presentation of Source of Cost of Electricity," has been included to give a general visualization of the relative cost of electric energy at different points on the power system. This plate is based upon an analysis of the costs in 1923 on one of the largest systems in California. The average costs per kilowatt hour are shown at different points on the production and transmission systems and for deliveries to different classes of service. Although the costs indicated are not directly applicable to the conditions in northern California in 1928, they are sufficiently close to present costs to be used for qualitative analysis.

The average cost of 0.374 cent per kilowatt hour from hydro-electric plants is close to that existing on the main systems of northern California at the present time. Many of the hydro-electric plants are closer to the market than the Pit River or Kennett development, and this cost represents practically the equivalent value to Kennett power when weight is given to the difference in location relative to the market.

In this plate, the steam-electric standby service has been assumed to be delivered after secondary transmission and just prior to delivery to the distribution substation. The figure of 0.752 cent per kilowatt hour, cost at intake of substation, is therefore not camparable to the value of approximately five mills per kilowatt hour heretofore set forth for delivery at the terminal of the main transmission line near Antioch. The larger figure is due to the cost of extensive secondary transmission systems. The average of 0.836 cent per kilowatt hour represents the average cost of the combined hydro-electric and steam-electric power delivered from the secondary transmission or distribution substations. Beyond this point, the average costs are shown for wholesale power delivery to large industries, and resale to private and municipal companies and retail delivery to general power consumers and to the residential and commercial lighting consumers.

Study of the rates fixed by the Railroad Commission for the various classes of service indicates that the resultant average revenues from the several classes of services agree fairly closely with the average costs as indicated in Plate XI.

PROBLEMS INVOLVED IN PLAN 5.

Table 14, heretofore referred to, indicates that complete utilization of the Kennett output would require the development, measured at main transmission terminals, of a load of 1,275,000,000 kilowatt hours annually, or 26 per cent of the total estimated load for the entire tributary market in 1936.

From consideration of the characteristics of the power requirements of urban and rural territory, it is apparent that to distribute the output of the plant readily and economically will require a market to be developed having a balanced percentage of both urban and rural service.

There are only two means of developing a market for the output of the plant under this plan:

1. Competition with and duplication of existing systems.
2. Condemnation of sufficient of the existing agencies' systems, either directly by the State or by political subdivisions to make such a market available.

COMPETITION WITH AND DUPLICATION OF EXISTING SYSTEMS.

Competition would involve duplication of facilities, both in rural and urban districts, over a considerable portion of the entire northern part of the State in order to obtain a balanced market. Separately, neither rural nor urban districts would furnish a market that could readily absorb the output. On the basis of a division of the load in the competitive field equally between existing agencies and the State, the competition would have to be extended over nearly half of the market.

The procedure of obtaining a market by competition with a duplication of existing systems with its economic losses, is so far from being economically sound that it should not be given any further consideration.

CONDEMNATION OF EXISTING SYSTEMS.

Service of power load independently of existing agencies by condemnation or duplication of parts of their systems will require a greater expenditure for production and transmission capital than in the case

of the wholesaling of power as heretofore estimated. Kennett development, being located some 200 miles from the general market, would require additional transmission circuits and primary substations if operated independently of the existing systems and steam-electric standby capacity somewhat in excess of that indicated for comparative purposes in Table 14. In addition, secondary transmission lines and distribution systems would be required. Analysis of costs under Plans 1, 2, 3 and 4 has been based upon operating the plant as a part of a large coordinated system under which conditions the minimum of transmission capital would be required. The approximate capital investment for production, trunk transmission and steam-electric standby to serve the entire output of the plant, as estimated in Table 14, would have to be increased to at least the following:

Kennett reservoir and plant	$70,000,000
Main transmission line to terminal substations, three circuits	10,000,000
Substations	5,000,000
Steam-electric plant capacity for standby, 100,000 kilowatts	11,000,000
Total	$96,000,000

This does not include any amount for secondary transmission and distribution. The cost of secondary transmission and distributing systems necessary to market the load will depend upon what portions of the territory the State would choose to serve; the price that would have to be paid for the existing systems for both tangible properties and intangible values and severance damages; and the length of time required to purchase the systems.

Delays in obtaining a market could be expected, for condemnation proceedings at the best are slow. There is, therefore, a probability that the necessary distribution systems serving a sufficient market would not be available upon the completion of Kennett development. It is also doubtful whether certain districts would favor State ownership and operation as against local operation or a continuation of private service under regulation. A considerable development period, therefore, could be expected.

There are no criteria for estimating the prices that would have to be paid for secondary transmission and distribution systems and business of the existing utilities. Some indication of the cost may be obtained, however, from analysis of the cost of the physical property of existing systems. Study of the valuation of these properties indicates that the cost of secondary transmission and distribution systems in urban districts averages approximately $90 per thousand kilowatt hours of annual output of main substations. For rural systems it averages from $50 to $60, and for the combination as represented by the larger ultilities, approximately $65 per thousand kilowatt hours per annum of main substation output. On the basis of an average of $65 per thousand kilowatt hours annual delivery, capital expenditure for the physical plant required for distribution of Kennett power would be between $80,000,000 and $85,000,000. This, added to the cost of Kennett development, including trunk transmission lines and steam auxiliary plant, would make a total of approximately $180,000,000. To this would have to be added payments for going concern value and severance damages.

It is readily apparent that if the State were to go as far into the ownership and operation of distribution systems as would be necessary

to load a development such as Kennett, it would have to meet the growing demands of the territory being served. This would require continual outlay of capital for added power plants, transmission lines and distribution systems.

The minimum initial bond issue under Plan 5 would have to be not less than $200,000,000.

Disposition of power by wholesaling to municipalities for resale in urban districts and by State distribution in rural territory would not benefit the state as a producer of power beyond that under plans 3 or 4. Power sold to municipalities would have to be at rates equal to or less than private utility rates to meet the competitive market. This, as has been indicated in discussing Plan 3a, would result in no benefits over plans 3 or 4. Distribution of power in rural districts would add no extra return to the State, for this service is rendered at the present time at rates justified only by the combination of distribution in both urban and rural districts.

POSSIBLE ECONOMIES UNDER PLAN 5.

The present utility rates are based on the utility as a whole making a reasonable return after operating expenses. No added economy in operating expenses could be expected under State ownership and operation over private ownership, and, at least during the transition period until adequate State machinery had been perfected for taking over and operating such a large utility, there would be a tendency for even higher operating costs. Taxes which might be eliminated in the case of State ownership would represent no actual saving to the State except possibly as a temporary condition in the case of federal tax, as the income to the State from taxes would be reduced by an amount equivalent to the reduction in operating costs of the electric system resulting from elimination of taxes. The source of possible economy under State ownership is represented in the difference between the rate allowed the private companies for return and depreciation annuity and the comparable cost to the State. The cost to the State must include not only the actual payment for interest and depreciation annuity but also the cost of contingencies and hazards, which is covered in the return allowed the private companies. These hazards and contingencies may be classified as heavy losses due to earthquakes, floods, extensive failures of structures, the general obsolescence of the service as a whole and periods of economic depression.

The cost of these hazards is not subject to any exact determination. Rates of return allowed private companies are in some cases as much as 1 per cent above the theoretical cost of money. Many of the steam and electric railroads have experienced an obsolescence of service that has made impossible an earning much in excess of the operating expenses of the properties. This same condition might occur in the case of power systems. The return over theoretical cost and obsolescence of service of other utilities can be considered only as indicative of the possible extent of hazards.

The apparent differential, as indicated by the comparison of rate of return, on the one hand and rate of interest, on the other is considerably in excess of the net differential. Differences in depreciation rates will reduce the differential approximately 0.6 per cent. It is doubtful whether the net differential in rate would equal 1.5 per cent per annum as applied to the problem herein considered.

The differential in the case of complete State distribution of power from Kennett development would be largely offset by the fixed charges on the extra cost over the rate base for private utilities which would probably be incurred in connection with development of a market and the payment for severance damages and intangibles.

If distribution in urban districts were not handled by the State but confined to rural districts, the differential would be applicable to secondary transmission and rural distribution capital. In this case little or no saving would be actually available on account of the relatively low present rates in effect in rural districts.

It is doubtful if Plan 5 would assist sufficiently in carrying Kennett development to justify the added capital expenditures and service obligations that would be required of the State.

LIST OF POWER PLANTS IN CALIFORNIA, 1927. DELINEATED ON PLATE I

Group	*System*	*Company and plant*	*Classification*	*Index number*
Northern	I	CALIFORNIA OREGON POWER CO.		
		Fall Creek	Hydro-electric	1
		Copco No. 1	Hydro-electric	2
		Copco No. 2	Hydro-electric	3
		Shasta River	Hydro-electric	4
		Headlight	Hydro-electric	5
Northern	I	PACIFIC GAS AND ELECTRIC CO. AND ITS SUBSIDIARY COMPANIES		
		Pit No. 1	Hydro-electric	6
		Pit No. 3	Hydro-electric	7
		Hat Creek No. 1	Hydro-electric	8
		Hat Creek No. 2	Hydro-electric	9
		Eureka	Steam-electric	10
		Junction City	Hydro-electric	11
		Kilarc	Hydro-electric	12
		Cow Creek	Hydro-electric	13
		Volta	Hydro-electric	14
		Coleman	Hydro-electric	15
		Inskip	Hydro-electric	16
		South	Hydro-electric	17
		De Sabla	Hydro-electric	18
		Centerville	Hydro-electric	19
		Lime Saddle	Hydro-electric	20
		Coal Canyon	Hydro-electric	21
		Bullards Bar	Hydro-electric	22
		Colgate	Hydro-electric	23
		Spaulding No. 1 and No. 2	Hydro-electric	24
		Deer Creek	Hydro-electric	25
		Drum	Hydro-electric	26
		Alta	Hydro-electric	27
		Halsey	Hydro-electric	28
		Wise	Hydro-electric	29
		El Dorado	Hydro-electric	30
		American River	Hydro-electric	31
		Folsom	Hydro-electric	32
		Sacramento, Station "B"	Steam-electric	33
		Electra	Hydro-electric	34
		Spring Gap	Hydro-electric	35
		Stanislaus	Hydro-electric	36
		Phoenix	Hydro-electric	37
		Melones	Hydro-electric	38
		Stockton	Steam-electric	39
		North Beach	Steam-electric	40
		San Francisco, Station "A"	Steam-electric	41
		Oakland, Station "C"	Steam-electric	42
		Monterey	Steam-electric	43
Northern	I	CITY OF SAN FRANCISCO		
		Cherry Creek	Hydro-electric	44
		Moccasin Creek	Hydro-electric	45
Northern	I	SNOW MOUNTAIN WATER AND POWER CO.		
		Potter Valley	Hydro-electric	46
Northern	I	UTICA MINING CO.		
		Murphy	Hydro-electric	47
		Angels	Hydro-electric	48
Northern	I	COAST COUNTIES GAS AND ELECTRIC CO.		
		Big Creek (Swanton)	Hydro-electric	49
		Santa Cruz	Steam-electric	50
Northern	I	SOUTH SAN JOAQUIN AND OAKDALE IRRIGATION DISTRICTS		
		Melones Mine	Hydro-electric	51
Northern	I	WEST SIDE LUMBER CO.		
		Tuolumne	Steam-electric	52
Northern	I	TRUCKEE RIVER POWER CO		
		Farad	Hydro-electric	53
Northern	II a	GREAT WESTERN POWER CO. OF CALIFORNIA		
		Caribou	Hydro-electric	54
		Bucks Creek	Hydro-electric	55
		Las Plumas	Hydro-electric	56
		North Beach	Steam-electric	57
		Phelan	Steam-electric	58
		Bush	Steam-electric	59
		Oakland	Steam-electric	60

Group	System	Company and plant	Classification	Index number
Southern	II–b	SAN JOAQUIN LIGHT AND POWER CORPORATION		
		Kittridge	Hydro-electric	61
		Mountain King	Hydro-electric	62
		Merced Falls	Hydro-electric	63
		Crane Valley	Hydro-electric	64
		San Joaquin No. 1	Hydro-electric	65
		San Joaquin No. 1–A	Hydro-electric	66
		San Joaquin No. 2	Hydro-electric	67
		San Joaquin No. 3	Hydro-electric	68
		Kerckhoff	Hydro-electric	69
		Balch	Hydro-electric	70
		Tule River	Hydro-electric	71
		Kern Canyon	Hydro-electric	72
		Bakersfield	Steam-electric	73
		Midway	Steam-electric	74
		Bettravia	Steam-electric	75
Southern	II–b	MERCED IRRIGATION DISTRICT		
		Exchequer	Hydro-electric	76
Southern	II–b	TURLOCK AND MODESTO IRRIGATION DISTRICTS		
		Don Pedro	Hydro-electric	77
		La Grange	Hydro-electric	78
		Modesto	Steam-electric	79
Southern	II–b	UNITED STATES NATIONAL PARK SERVICE		
		Yosemite Park	Hydro-electric	80
Southern	III	SOUTHERN CALIFORNIA EDISON CO.		
		Big Creek No. 1	Hydro-electric	81
		Big Creek No. 2	Hydro-electric	82
		Big Creek No. 2–A	Hydro-electric	83
		Big Creek No. 3	Hydro-electric	84
		Big Creek No. 8	Hydro-electric	85
		Kaweah No. 1	Hydro-electric	86
		Kaweah No. 2	Hydro-electric	87
		Kaweah No. 3	Hydro-electric	88
		Visalia	Steam-electric	89
		Tule River	Hydro-electric	90
		Kern River No. 3	Hydro-electric	91
		Borel	Hydro-electric	92
		Kern River No. 1	Hydro-electric	93
		Azusa	Hydro-electric	94
		Sierra	Hydro-electric	95
		Lytle Creek	Hydro-electric	96
		Fontana	Hydro-electric	97
		Santa Ana No. 1	Hydro-electric	98
		Santa Ana No. 2	Hydro-electric	99
		Santa Ana No. 3	Hydro-electric	100
		Mill Creek No. 1	Hydro-electric	101
		Mill Creek No. 2–3	Hydro-electric	102
		Redondo	Steam-electric	103
		Long Beach	Steam-electric	104
		San Antonio Creek No. 1	Hydro-electric	105
		San Antonio Creek No. 2	Hydro-electric	106
		San Antonio Creek No. 3	Hydro-electric	107
Southern	III	CITY OF LOS ANGELES		
		Big Pine No. 3	Hydro-electric	108
		Division Creek No. 1	Hydro-electric	109
		Division Creek No. 2	Hydro-electric	110
		Cottonwood No. 1	Hydro-electric	111
		Haiwee	Hydro-electric	112
		San Francisquito No. 1	Hydro-electric	113
		San Francisquito No. 2	Hydro-electric	114
		San Fernando	Hydro-electric	115
		River Power	Hydro-electric	116
		Franklin Canyon	Hydro-electric	117
Southern	III	CITY OF PASADENA		
		Pasadena	Steam-electric	118
Southern	IV	LOS ANGELES GAS AND ELECTRIC CORPORATION		
		Alameda Street	Steam-electric	119
		Seal Beach	Steam-electric	120
Southern	IV	SOUTHERN SIERRAS POWER CO.		
		Mill Creek	Hydro-electric	121
		Poole (Leevining Creek No. 1)	Hydro-electric	122
		Leevining Creek No. 3	Hydro-electric	123
		Rush Creek	Hydro-electric	124
		Adams auxiliary	Hydro-electric	125
		Adams main	Hydro-electric	126
		Bishop Creek No. 2	Hydro-electric	127
		Bishop Creek No. 3	Hydro-electric	128

Group	System	Company and plant	Classification	Index number
Southern	IV	SOUTHERN SIERRAS POWER CO.—Continued.		
		Bishop Creek No. 4	Hydro-electric	129
		Bishop Creek No. 5	Hydro-electric	130
		Bishop Creek No. 6	Hydro-electric	131
		San Bernardino	Steam-electric	132
		San Gorgonio No. 1	Hydro-electric	133
		San Gorgonio No. 2	Hydro-electric	134
		Blythe	Gas-electric	135
		El Centro	Steam-electric	136
Southern	IV	SAN DIEGO CONSOLIDATED GAS AND ELECTRIC CO.		
		Station "A"	Steam-electric	137
		Station "B"	Steam-electric	138
Southern	IV	ESCONDIDO MUTUAL WATER CO.		
		Rincon	Hydro-electric	139
		Bear Valley	Hydro-electric	140
Southern	IV	UNITED STATES RECLAMATION SERVICE		
		Yuma	Hydro-electric	141

LIST OF SUBSTATIONS. DELINEATED ON PLATE I

Group	System	Company and substation	Index letters
Northern	I	PACIFIC GAS AND ELECTRIC CO.	
		Vaca-Dixon	A
		Contra Costa	B
		Newark	C
Northern	II–a	GREAT WESTERN POWER CO. OF CALIFORNIA	
		Antioch	D
		Golden Gate	E
		Brighton	F
Southern	II–b	SAN JOAQUIN LIGHT AND POWER CORPORATION	
		Wilson	G
Southern	III	SOUTHERN CALIFORNIA EDISON CO.	
		Vestal	H
		Eagle Rock	I
		Laguna Bell	J
		Lighthipe	K

EXHIBIT "C"

REPORT OF THOS. H. MEANS,

Consulting Engineer

ON SALT WATER PROBLEMS OF SAN FRANCISCO BAY AND DELTA.

THOS. H. MEANS
CONSULTING ENGINEER
216 Pine Street
SAN FRANCISCO

Telephone Sutter 78

June 15, 1928.

Association of Industrial Water Users of Contra Costa and Solano Counties.

Dear Sirs:

Statements in this report on pages 39, 51, 56, 63 and 69 concerning the proposed Southern Pacific Railroad's Suisun Bay Bridge, located near Army Point, were published before the plans of that company were made public. The information now available shows that the site selected for the railroad bridge lies from 800 to 1800 feet above the location for the Salt Water barrier selected by Mr. Young. The plans for the bridge provide for piers founded on rock over both the waterway and marsh areas. The experiences of the railroad do not favor the location of the tracks upon rock fill dikes, as proposed by Mr. Young, but would require piers to rock throughout the length of the structure. According to estimates by the railroad company's engineer, the saving in cost by combining the railroad bridge with the barrier under these conditions would be small and the disadvantage of having the lift span located close to locks, where the movement of vessels is slow, serves to offset any saving in cost.

The railroad bridge as planned provides for a bridge giving a clearance of 70 feet (as compared with 50 feet in Young's plans), a height great enough to permit the free passage of river boats. The lift span will be used for ocean-going vessels. Piers are spaced 413 feet on centers and foundations in all cases will be carried to bedrock. The construction of the barrier as proposed by Young will not be interfered with if this site is selected.

The estimated cost of the bridge now proposed is about $6,400,000, exclusive of approaches, track, etc.

There is no advantage to be gained by a combined structure unless the result is in decreased cost to both barrier and railroad. Since there is apparently no such advantage to be gained and the bridge will not interfere with the barrier if the Army Point site is located, I suggest that this letter be attached to my report in correction of the statements made therein.

Very truly yours,

THOS. H. MEANS.

PREFACE

The following report by Engineer Thos. H. Means was financed by the Association of Industrial Water Users of Contra Costa and Solano counties.

The only instructions given Mr. Means in preparing this report were to get the facts, and it is hoped that this document will be of benefit in establishing some of the facts relating to the proposed Salt Water barrier as designed by Engineer Walker R. Young.

The following firms are members of the Association:

American Smelting & Refining Co.
Associated Oil Company
Atchison, Topeka & Santa Fe Railway Co.
F. E. Booth Company
California-Hawaiian Sugar Refinery
Columbia Steel Corp.
Coos Bay Lumber Co.
Fibreboard Products, Inc.
General Chemical Co.
Great Western Electro Chemical Co.
C. A. Hooper & Co.
Johns-Manville, Inc.
Kullman-Salz & Co.
Mountain Copper Co.
Pioneer Rubber Mills
Redwood Manufacturers Co.
San Francisco & Sacramento R. R.
Shell Company of California
Southern Pacific Company
Union Oil Company

ASSOCIATION OF INDUSTRIAL WATER USERS
OF CONTRA COSTA AND SOLANO COUNTIES.
C. W. SCHEDLER, *Chairman.*

PENETRATION OF SALT WATER IN UPPER BAY AND LOWER RIVER REGION

Under natural conditions, Carquinez Straits marked, approximately, the boundary between salt and fresh water in the upper San Francisco Bay and delta region of the two tributary rivers—the Sacramento and San Joaquin. Ordinarily salt water was present below the straits and fresh water was present above. Native vegetation in the tide marshes was predominantly of salt water types around San Pablo Bay and of fresh water types around Suisun Bay.

In tidal waters, into which run fresh water streams of variable flow, there is an ebb and flow of salt water and the zone of mixing will move up and down stream as the fresh water flow increases and decreases. For short intervals in late summer of years of minimum flow, salt water penetrated the lower river and delta region, and in wet seasons the upper bay was fresh, part of the time, to the Golden Gate. This variation in quality of water was not, however, of sufficient duration to affect the characteristic vegetation growth of the regions on each side of the straits, nor to change the designation of Suisun Bay as ordinarily a fresh water body and San Francisco Bay as salt water.

The works of man have changed conditions in many ways. The most important changes have been brought about gradually—so slowly as to be hardly noticeable. The dry season of 1918—when large summer diversions for irrigation in the Sacramento Valley resulted in the sudden penetration of salt water farther upstream than ever known before, at such an early period in summer—first brought the salt water problem to public notice. The slow effects of increasing diversions in previous years had escaped notice, but were brought prominently to the attention of the inhabitants of the upper bay and delta regions in this year. Since 1918, the dry years of 1920, 1924 and 1926 have more convincingly demonstrated the importance of the salt water problem.

An accurate picture of natural conditions is not possible, because no records have been collected on which such a picture can be based, but very close approximations can be made. The log of the distance traveled by the water barge of the California-Hawaiian Sugar Company in going upstream to obtain fresh water has been kept since 1908. These figures give the means of determining approximately the conditions during that period. In 1908 irrigation had been extensively developed in both valleys and conditions then were not natural. For an estimate of earlier conditions we must go to the stream flow records of the tributary streams before important diversions are taken out.

It is the practice of the sugar company to send the barge upstream until water of approximately 50 to 70 parts per million chlorine is reached. The crew of the barge are equipped with apparatus by which water is analyzed until this degree of purity is reached. Since trips are made nearly every day during the summer months, the record is a very good indication of the point reached by salt water. A summary of the complete records shows the fluctuation of the line between fresh and salt water. Records of the sugar company are attached. (Table 1.)

The Sugar Company requires water of great purity. For irrigation, domestic or ordinary industrial uses, water of a lesser degree of purity may be used. A comparison of the point where the sugar company's

barge is filled with the point where the remaining uses could be satisfied, indicates that from five to ten miles downstream from the place where the barge turns, water could be obtained satisfactory for domestic supply. Making an allowance of 7½ miles in the average records, we find that an average flow of 5000 second-feet in both streams will maintain fresh water at Collinsville; 7000 second-feet will maintain fresh water at the San Francisco-Sacramento ferry.

If we sum up the flow of the important tributaries of the Sacramento and San Joaquin rivers at the points where these streams leave the mountains and assume that this flow under natural conditions would have reached the head of the Suisun Bay, we will find that at no time in the past ten years would the average monthly flow have been less than 5100 second-feet. It is probable, should all streams be running in a natural way, that salt water would have penetrated no farther in this extremely dry period than Antioch, and then only for a few days at a time.

It is not possible to make a more detailed study of this condition without making a number of assumptions as to speed of flow from the gaging stations to the head of the bay, and there is little accurate information on which the assumptions may be made. The definite statement that salt water under natural conditions did not penetrate higher upstream than the mouth of the river, except in the driest years and then only for a few days at a time, is warranted. (See Table 2 for monthly flow of tributary streams.)

At present salt water reaches Antioch every year, in two-thirds of the years running further upstream. It is to be expected that it will continue to do so in future, even in years of greatest run-off. In other words, the penetration of salt water has become a permanent phenomenon in the lower river region.

Cause of Change in Salt Water Conditions.

The cause of this change in the salt water condition is due almost entirely to the works of man. If natural changes have had any effect, it is too small to be measured. The most important natural condition is the sequence of dry and wet yeriods. Since 1917 the state has experienced dry years with low run-off in nearly all streams. During this period two years have exceeded normal stream flow in some streams (1921 and 1927). In each of these years excessive salinity (over 100 parts chlorine per 100,000) was present at Antioch about two months.

Irrigation

Storage and diversion of water have been the principal causes of salinity increase in the upper bay country. The area irrigated varies from year to year; in 1926 the acreage of lands on the floor of the valley was approximately as follows:

Estimate of Diversions and Area Irrigated 1926—Sacramento and San Joaquin Valleys, Not Including Mountain Areas

	Acre-feet diverted	*Acres irrigated*
Sacramento and tributaries above Sacramento, including rice, 128,439 acres	1,644,973	235,995
Delta uplands	146,906	53,649
Delta area		264,479
San Joaquin Valley estimated	2,100,000	700,000
	3,891,879	1,254,123

In addition to this area on the valley floor, there is a large acreage in the mountains which uses water from the streams tributary to the rivers that drain through Suisun Bay. The acreage irrigated in the mountains is not so accurately known as the area on the valley floor, but it is large and, particularly in low flow seasons, very effectively uses up the water in the streams. The use of the water in the mountains is usuallly more economical than in the valley and the return seepage is less. The net effect is to consume all the water diverted. The effect upon the flow is pronounced.

The latest accurate determination of area irrigated is that made by the United State Census.

Irrigation in California
Census of 1920

	1902	*1919*	*1920* *Area in enterprises*	*1920* *Area capable of irrigation*
Sacramento River and tributaries	206,312	640,950	1,204,769	864,605
Sacramento River direct	10,942	194,397	439,169	296,748
Pit River	72,072	89,984	129,984	107,478
Cow Creek	2,321	6,068	12,488	7,446
Cottonwood Creek	1,858	2,972	21,016	4,112
Battle Creek	2,642	2,966	6,590	5,108
Stony Creek	4,110	23,559	45,143	36,191
Feather River	67,111	142,841	186,756	167,463
Yuba River	Not Rep.	19,473	69,074	23,492
Cache Creek	3,756	24,541	56,498	31,212
American River	10,112	47,156	82,695	52,842
Other tributaries	31,388	86,993	155,356	132,513
San Joaquin River and tributaries	220,651	1,069,161	2,072,739	1,497,661
San Joaquin River direct	129,647	642,261	1,083,862	873,300
Fresno River	10,729	12,412	30,004	14,016
Merced River	19,636	65,151	222,715	71,709
Tuolumne River	Not Rep.	165,533	298,418	250,425
Stanislaus River	13,840	75,359	155,453	111,192
Calaveras River	Not Rep.	13,323	21,598	16,489
Mokelumne River	5,558	36,848	155,480	72,144
Cosumnes River	Not Rep.	3,259	9,011	6,405
Other tributaries	41,241	55,015	96,198	81,981

The above includes springs and wells.

Where area in watershed is not reported (not rep.) it is included in other watersheds.

Records for other census periods have not been tabulated so as to be comparable.

This table shows that in the 18 years between 1902 and 1920 the area irrigated in the Sacramento Valley trebled, while in the San Joaquin Valley the increase was nearly five times as great. The area included in irrigation enterprises was only half watered in 1920, while the area capable of being irrigated was only about two-thirds watered. The total area irrigated in both watersheds was 1,710,000 acres in 1920.

No accurate records have been collected since 1920. It is known, however, that the growth of irrigation has continued, though at a slower rate than prior to 1920. Since 1920 the growth in area has been proportionately larger in the San Joaquin than in the Sacramento Valley. In the latter valley grain production (seldom irrigated) is still profitable and much land within irrigation projects goes into grain. Other crops, such as rice, vary in area with the price of rice.

United States Department of Agriculture tabulation of area in rice in California is shown below:

Acres in Rice in California

1920	162,000
1921	135,000
1922	140,000
1923	106,000
1924	90,000
1925	103,000
1926	149,000

Storage reservoirs, both for irrigation and power, have been built on many streams in the past fifteen years. Many others are planned and their construction will be undertaken within a short time. The following list of reservoirs is as complete as it is possible to make it. Small reservoirs—less than 1000 acre-feet capacity—have been omitted.

Storage Reservoirs

Golden Gate Drainage Watershed

Sacramento Basin		*Height of dam*	*Reservoir capacity, acre-feet*
Cottonwood Creek	Misselbeck Reservoir	105	5,460
Pit River	Darris Reservoir	---	12,500
Pit River	Big Sage Reservoir	---	------
Pit River	Mt. Shasta Power Co. No. 3	112	36,000
Stony Creek	East Park	139	51,000
	Stoney Gorge	120	50,000
Paradise Creek	Paradise Reservoir	---	------
Battle Creek	2 Reservoirs	---	3,000
Feather River	Lake Almanor	125	1,317,000
	Bucks Creek	128	103,000
	Butte Valley	115	106,000
Yuba River	Bullards Bar	183	11,000
	Lake Francis	70	2,400
	Spalding	---	74,000
	25 Reservoirs, small	---	54,000
	Bowman being enlarged	---	------
American	4 Reservoirs	---	12,800
Mokelumne	Pardee under construction	350	200,000
	Electra System, 7 Res.	---	24,800
Stanislaus	Salt Springs, under construction	300	130,000
	Relief	140	15,000
	Strawberry	135	18,000
	Utica, 3 Reservoirs	---	8,900
	Woodward	---	36,000
	Melones	191	112,500
Tuolumne	Hetch Hetchy	---	------
	O'Shaughnessy Dam	344	206,000
	Dom Pedro	284	290,000
	Lake Eleanor	---	25,300
	Dallas Warner	---	28,000
	Davis	---	48,000
Merced	Exchequer	330	278,000
San Joaquin	Florence Lake	---	64,500
	Huntington	165	88,700
	Shaver Lake	183	138,500
	Crane Valley	150	38,000
Cache Creek	Clear Lake	---	400,000
Suisun Creek	Gordon Valley	104	10,000
Total Constructed Reservoirs			3,998,360

Projected Reservoirs (Partial List)

Sacramento	Kennett	420	2,838,000
	Iron Canyon	---	709,000
American	Folsom	220	300,000
Mokelumne	Dry Creek	140	1,200,000
Tuolumne	O'Shaughnessy, increased to	430	350,000
Total Projected Reservoirs			5,397,000

In round numbers, reservoirs of a capacity of 4,000,000 acre-feet are in use on streams tributary to San Francisco Bay above Carquinez Strait. Reservoirs of much larger capacity are being considered for future construction.

Mining Debris. Mining debris and sediment in the rivers and by-pass channels have probably changed the tidal flow to a small extent, and may have affected salt water movements. The effect has been too small to measure, but it has been generally in the direction of reducing tidal prism and tidal flow where the deposits are laid down in bay waters, and of increasing tidal flow through the Golden Gate where deposited in the rivers. The net change has probably been very small. Gilbert, in his report upon Hydraulic Mining Debris (U. S. G. S. Prof. Paper 105, page 87) estimates the reduction in tidal currents in Golden Gate caused by deposition of debris as 2.49 per cent.

Land Reclamation. Reclamation of land by building levees has affected tidal flow and movement of salt water in two ways: first, by decreasing the tidal prism in the delta and, second, by changing the time of arrival of floods and of low water.

First, Reduction of Tidal Prism: The reduction in tidal prism by the construction of levees in the delta region and around the upper end of San Pablo Bay and around Suisun Bay has probably had the effect of slightly reducing the tidal flow through Golden Gate. As has been shown by Gilbert in the publication above referred to, the effect of leveeing in the lower river has had the tendency of increasing Golden Gate flow, while the same work in Suisun and San Pablo Bays has had the opposite effect. The net effect, however, is small and results in decreased flow. Gilbert (U. S. Geologic Survey Professional Paper 105, page 79) estimates the average percentage of the flow through Golden Gate as follows, when all marshes are leveed:

Marsh Land Areas—Average Volume Flowing Through Golden Gate Expressed in Percentage

	Per Cent
San Pablo marshes and Napa River	*1.95
Suisun Bay	*1.18
Sacramento Delta	†1.04
San Joaquin Delta	†3.35
Net effect on Golden Gate flow	†1.26

Second, Change in Time of Arrival of Floods: The effect of leveeing upstream from tide lands has been to decrease the storage in basins and to increase the rate of travel in floods toward tide water. Under natural conditions the basin areas filled with water in flood time and slowly released this water in late summer, maintaining the flow well into the period of low water.

* Means decrease in tidal flow through Golden Gate.
† Means increase in tidal flow through Golden Gate.

Most of these up-river basins have been leveed and floods run through the river channel and by-passes to the ocean with very little retardation by storage. There is no stored water from these basins to maintain low flow, consequently the low flow reaches the tidal channels earlier in the year than under natural conditions.

The effect of this reclamation work upon salt water conditions has been very pronounced. In the period just prior to 1918, some of the largest reclamation districts were leveed, Sutter Basin being a notable example. Prior to this closing off from flood flows these basins retained large volumes of water, sometimes until the middle of summer, the water slowly draining back into the channel. Nowadays instead of delivering water to the channel, water is taken from the channels for irrigation during the summer months. Drainage returns a small part of the irrigation water directly to the river.

Return seepage from irrigation has had the effect of increasing the low water flow in the Sacramento. Stafford, in publications of the Division of Water Rights (Biennial Report November, 1924, page 133; Sacramento-San Joaquin Water Supervisor's Report 1926, page 85) estimates the water returned to the Sacramento River as follows:

Water Returned to Sacramento River (Including All Accretions)

Flow in Second-Feet

	1924	1925	1926
July	879		2,280
July	734	1,624	1,573
August	785	1,320	1,240
September	684	1,310	1,077
October		160	
Mean	763	1,179	1,543

Dredging, particularly in the Sacramento River, near its mouth, has had the effect of increasing the water prism, but the probable effect upon tides through Golden Gate is to decrease them. The dredging work is so far up-stream as to be on the tidal movement opposite to that in the Golden Gate.

The deepening of the channel has, further, the effect of permitting the deep flowing salt water to pass upstream with more ease through the deep channel. A like effect will probably result from deepening of Suisun Bay and San Joaquin River to Stockton, a navigation project authorized by congress.

It is not possible to measure these effects, but it is well established that salt water being heavier moves along the bottom of deep channels with greater ease than over shallow ones. Any deepening of channels or straightening of approach through dredger cuts has the tendency to facilitate the movement of the deeper waters.

Irrigation and Storage of Water in the San Joaquin Valley. Irrigation in the San Joaquin Valley has had an effect upon tidal conditions and the movement of salt water in two ways: first, by diverting and storing water during flood period, and second, by increasing the flow in late summer and fall months through return seepage.

A much larger utilization of water resources has taken place in the San Joaquin than in the Sacramento Valley. Rainfall is lighter on the floor of the valley, so dry farming has been less profitable and there is greater necessity of irrigation. All streams tributary to the bay are

now completely diverted during the low flow period and no water enters the tidal channel except return flow. This condition has been true for over ten years.

The following brief description of the streams and the irrigated area will show the extent to which the water supply has been put to use.

Upper San Joaquin. The upper San Joaquin enters the valley floor at Friant. The mean annual flow of the stream at the valley's edge averages 2,050,000 acre-feet. Storage above this point, built by the San Joaquin Light and Power Corporation and the Southern California Edison Power Company under contract with riparian owners and appropriative users of water, amounts to 330,000 acre-feet. Other storage reservoirs have been planned. Lands irrigated from the stream lie on both sides of the river and aggregate 400,000 acres. The diversion capacity of the ditches, sloughs and canals in use is very large.

Above the Merced River, canals, ditches and sloughs with control gates have a capacity in excess of 7000 second-feet. Sloughs and channels used for wild flooding increase this diversion capacity to in excess of 10,000 second-feet. Below the Merced, a number of pumps take water from the river to West Side slope. Down to Paradise Dam, about the head of tide water, these diversions total in excess of 500 second-feet.

All water entering the valley is diverted in late summer. The San Joaquin is dried above Merced for three or four months a year. Return seepage commences to "make" about the mouth of the Merced. Below that point there is always water in the channel, except for short periods of time, just below some of the larger pumping plants.

Fresno River. This stream has a small watershed area of low mountains with a mean annual flow of 68,000 acre-feet. The entire low flow is utilized around Madera and toward the San Joaquin. No return seepage makes from this area, as pumping plants have lowered the ground water plane and probably intercept nearly the entire ground water flow.

Chowchilla River. This stream has about the same area and topographic conditions in its watershed as has the Fresno. Its mean flow approximates 68,000 acre-feet. All low flow is utilized. Pumping has been heavy on its lower course. No return seepage makes from this area.

Merced River. The Merced Irrigation District and riparian lands lying above the junction with the San Joaquin utilize all low flow. The Exchequer Reservoir of the Merced District, with a storage capacity of 278,000 acre-feet, controls the stream except in wet years. The power plant at the dam delivers water into the river, when water is plentiful, in excess of the district's diverting capacity. Water always passes the district's headgate for use of lands lower down on the Merced. The mean flow of the stream is 1,330,000 acre-feet. Return seepage maintains a continuous flow at the mouth of the Merced, the water coming from both the Turlock and Merced sides of the river. This return flow now amounts to 80 to 100 second-feet in summer months and there are indications that it is increasing. Pumps along the Merced utilize a part of this return flow.

Tuolumne River. The Tuolumne drains a high mountain area and has a mean annual flow of 2,055,000 acre-feet. Three irrigation districts—the Waterford, Modesto and Turlock, with a total of 276,783

acres—divert water at the LaGrange Dam. Three storage reservoirs with capacity of 366,000 acre-feet are operated by these districts. The City of San Francisco has rights on the upper watershed for water for domestic uses and has built reservoirs of capacity of 231,000 acre-feet. A conduit of capacity of 620 second-feet is under construction. San Francisco has control of other reservoir sites and proposes, ultimately, to divert 400 million gallons daily (620 second-feet) from the watershed. To do this, storage of about 850,000 acre-feet will be required.

Return seepage in the Tuolumne, at its mouth, resulting from irrigation now amounts to from 250 to 350 second-feet constant flow. Additional seepage from these irrigated areas appears in the Merced, the Stanislaus and San Joaquin rivers.

Stanislaus River. The Stanislaus River (mean annual flow, 1,376,000 acre-feet) is under storage control for both power and irrigation. Power reservoirs with capacity built or being built of 172,000 acre-feet, high on the stream, increase the low flow, but this water is re-stored in reservoirs or diverted by the South San Joaquin and Oakdale irrigation districts. These districts, with an area of 145,548 acres, have in Melones and Woodward reservoirs a storage capacity of 148,000 acre-feet. All low flow is diverted. Return seepage in the Stanislaus River at its mouth (coming in part from the Modesto District) now varies from 100 to 160 second-feet constant flow. An additional amount enters the San Joaquin River.

Return Flow in the San Joaquin River. Return seepage in the San Joaquin River from the mouth of the Merced to Durham Ferry (just above tide water) now amounts to a continuous flow of from 600 to 1000 second-feet. About 300 second-feet of this water is diverted above tide water by pumps irrigating West Side lands. Additional pumps recently installed or in process of installation and pumps diverting from the tidal portion of the stream have a combined capacity of between 750 and 800 second-feet. In the peak of the irrigating season these West Side pumps divert practically all of the visible flow in the San Joaquin River. The delta lands and islands are dependent upon ground water flow and such water as flows down the Calaveras, Mokelumne and connecting sloughs from the Sacramento River.

NET RESULT OF IRRIGATION AND STORAGE ON SALT WATER PROBLEM

Summarizing former statements upon the effect of irrigation and storage upon the flow of salt water in the lower river and upper bay region, the following may be said:

1. Under natural conditions the boundary between salt and fresh water was Carquinez Straits. In late summer, Suisun Bay became brackish but salt water penetrated as far as Antioch only rarely and then for but a few days' time.

2. The combined effects of irrigation and diversion in the Sacramento Valley have been to reduce the flow entering tidal waters to a small fraction of the flow under natural conditions. In 1924 the flow at Sacramento was about 720 second-feet and was below 1000 second-feet for in excess of a month. In 1925 the flow at Sacramento reached a minimum of 2750 second-feet and was below 3000 for nearly a month. In 1926 the flow of the Sacramento reached a minimum of 1200 second feet and was below 2000 for over a month.

3. The late summer flow of the San Joaquin (all return seepage) has been below 1000 second-feet in all years except 1927. The capacity of pumping plants irrigating West Side lands exceeds the inflow nearly every summer, so that, so far as visible flow in the San Joaquin is concerned, all of the late summer inflow into tidal channels is used on West Side area. The delta lands now must obtain their supply from the water stored in channels or which flows underground, or from the Calaveras, Mokelumne, and sloughs connecting with the Sacramento River.

4. The use of water by the delta lands on both San Joaquin and Sacramento rivers has not been accurately determined. The area irrigated amounts to 360,000 acres. If this area consumes $1\frac{3}{4}$ acre-feet of water per annum, of which 20 per cent is used in a month, the consumptive draft will be at the rate of 2100 second-feet. This quantity exceeds the low flow in years of light rain.

PRESENT CONDITIONS OF SALT WATER IN UPPER BAY AND LOWER RIVER REGIONS

Salt water conditions have been under observation by the Division of Water Rights of the Department of Public Works since 1917. Results have been published in the annual reports of this division. Earlier records of much value in the study of the problem are those of the California-Hawaiian Sugar Company, referred to earlier in this report, covering the period from 1908 to 1920. In 1920 the Sugar Company obtained a supply from the Marin Municipal Water District at San Quentin Point, approximately 15 miles from Crockett. Since then, when the distance traveled upstream to fresh water is less than 15 miles, the water is taken from the river; when the distance exceeds 15 miles, the Marin County water is used.

A number of other investigations of salt water conditions have been collected at various places and are of help in the determination of the changes which have taken place in recent years. Among these records are those collected by Mr. William Pierce north of Suisun Slough, on the north side of Suisun Bay; records for a short period by the Pacific Portland Cement Company at Suisun, showing salinity of Suisun Slough; records of the Great Western Electro Chemical Company at Pittsburg, extending from 1916 to date, giving total solids and chlorine in the river water; and information collected at various times in the investigation of water supplies by the City of San Francisco, the City of Richmond, and the East Bay Water Company. A large amount of information from these various sources has been obtained and is helpful in interpreting the changes which have taken place and in formulating a fairly accurate conception of conditions in the past and what may be expected in the future.

Attached to this report is a chart of the region, the base being photographed from the annual report of the Division of Water Rights. On this chart red lines have been placed showing the penetration of salt water during the months of June and September, 1924. Similar charts for other years show that in every year, salt water has penetrated to a point beyond Antioch on the San Joaquin River and Collinsville on the Sacramento, and that in years of low flow, such as 1918, 1920, 1924 and 1926, the extreme limit of salt water penetration has been well into the delta region.

The year 1927 is one of approximately 100 per cent run-off in the streams tributary to San Francisco Bay. In this year salt water reached the middle of Suisun Bay in June, was approximately at Collinsville and Antioch in July, and during August and September had reached approximately to Emmaton on the Sacramento and the lower end of Jersey Island on the San Joaquin River.

Stream flow records show that approximately one-third of the years are in excess of 100 per cent run-off and two-thirds of the years below that figure. This gives, roughly, an approximation of the period of time in which salt water conditions will be worse than in 1927 and the period in which better results can be expected.

For practical purposes, a period of thirty days or more would be detrimental to either irrigation, domestic use or supply for industrial purposes. An examination of records in more detail indicates that, under the conditions now existing, in practically all dry years salt water will reach the lower end of the delta for at least a month's time, and that in two-thirds of the years water will be in the lower delta region in excess of a month's time or as much as three to four months.

The areas of delta land within the salt water flow are shown in the following table.

	Approximate stream flow in per cent, normal	*Area of delta penetrated by salt water*
1924	24	169,000
1925	74	8,500
1926	53	58,000
1927	100	5,000

PROSPECTIVE CHANGES IN THE FUTURE

Storage of water for power purposes and diversion for irrigation and domestic uses in the watersheds tributary to the bay are steadily increasing. The rate of increase of the irrigated area is not so rapid as during the decade 1910 to 1920, but there is a steady, continuous growth and plans are on foot for large increases in the use of water through new projects and through the extension of irrigation on old projects.

As illustrating the extent to which conditions are changing, reference may be made to the growth of the San Joaquin River basin since the year 1920, a period ordinarily regarded as one of stagnation in irrigation development in California. Since 1920, the Southern California Edison Power Company has constructed and placed in operation the Florence Lake and Shaver Lake Reservoirs on the San Joaquin River with a storage capacity of 203,000 acre-feet. This stored water will be diverted and used as fast as it is released for power purposes by the agricultural lands above the mouth of the Merced.

On the next stream, the Merced Irrigation District has built a storage reservoir of 278,000 acre-foot capacity and has approximately trebled the area in irrigation in 1920. The district is rapidly growing and the entire irrigable acreage in the total of 189,000 acres will be all in cultivation within a few years.

On the Tuolumne River, since 1920, the Modesto and Turlock Irrigation districts have built the Don Pedro Reservoir of 290,000 acre-foot capacity, and both districts have extensively increased their irrigated area. The growth is steady.

The Waterford District has acquired rights to use the water of the Yosemite Power Company, which formerly delivered approximately 60 cubic feet per second into the Tuolumne River below LaGrange Dam, further reducing the stream flow.

Since 1920 the City of San Francisco has built Lake Eleanor and the O'Shaughnessy Dam, storing 231,000 acre-feet. The water released from these reservoirs has not yet been diverted from the watershed, but it has been picked up, at least during the summer period, by the irrigation districts, and no water except return seepage has flowed into the Tuolumne River during the summer and early fall months.

On the Stanislaus River, the Melones Dam has been built by two irrigation districts in cooperation with the Pacific Gas and Electric Company, and the late summer use of water has been very much increased.

In addition the power companies have now under construction Salt Springs Reservoir on the headwaters of the Stanislaus, with the intention of ultimately raising this to storage capacity of 130,000 acre-feet. This water when released will be caught by the Melones and Woodward reservoirs lower on the stream and utilized during the late summer.

The East Bay Utility District has now under construction the Lancha Plana Reservoir site on the Mokelumne River, a reservoir of 200,000 acre-foot capacity, and has completed a pipe line from the Mokelumne to the East Bay district of a capacity of 60 million gallons daily (90 second-feet). The water to be diverted by this utility district will be taken out of the watershed and there will be no return flow from it.

In addition to the reservoirs and increased irrigated area on the east side of the San Joaquin, several pumping plants have been built, lifting water up the West Side slope for the irrigation of high lands. Important among these are the Banta-Carbona Irrigation District, approximately at the head of tide water, which commenced irrigating in 1925, and now has a pumping capacity of 220 cubic feet per second.

The Burkhart Ranch further south has installed a pumping capacity of about 50 cubic feet per second since 1920, and a number of other districts and appropriators of water have increased either the size of their pumping equipment or the extent of their use, so that at the present time the capacity of the pumping plants irrigating West Side lands exceeds the flow in the San Joaquin River at the place where tide water is reached.

Further extension of this irrigated area is in progress and one new district is now engaged in preparation of plans which will result in the pumping of approximately 300 second feet from the river.

Extension of area supplied by pumping from wells has been going on at the same time. In Fresno, Madera, Merced, Stanislaus and San Joaquin counties, hundreds of pumping plants have been installed since 1920, all drawing from water which, under natural conditions, would have its outlet to the sea through the San Joaquin River. It is impossible to accurately estimate the effect of this withdrawal of water upon the stream flow or the underflow to delta areas, but, if it has not already done so, it will at some time affect the flow by reducing the quantity of water which reaches the stream from underground sources and affecting to that extent the late summer discharge into tidal waters.

Irrigation development has not been so pronounced in the Sacramento watershed since 1920. There are a large number of irrigation and reclamation enterprises in the Sacramento Valley which have irrigation systems of a capacity larger than the irrigated area. There is, in addition, a large area of land still devoted to grain, rice, sugar beets and other general farm crops, which goes in and out of cultivation as economic conditions vary. The years when grain prices are high, large areas of grain go into cultivation, a portion of which is irrigated. With prospects of low prices for grain other crops are planted, some of which use more water than does grain. The most noticeable effect on the water supply, however, is the increase and decrease in the rice crop. The area irrigated in rice since the industry became stabilized varies from 130,000 to in excess of 200,000 acres a year, and in years of large crop the effect upon the water supply is very noticeable.

Although no large new enterprises have been built in the Sacramento Valley in recent years, the increase in irrigation in the older districts has been steady. The area devoted to orchards, to alfalfa, and to general farm crops requiring irrigation, steadily increases. The result has been continued drafts upon the supply from the river and to gradual reduction in the total flow downstream from the main cultivated section. The reduction in flow, to some extent, has been controlled by the operations of the Division of Water Rights through the commissioner appointed to superintendent the diversions from the Sacramento and San Joaquin rivers. The principal effect of the work of the Commissioner has been to reduce the waste of water, to encourage economy and to endeavor to keep the flow at Sacramento as high as possible, both for purposes of navigation and the use of delta lands.

Return seepage and waste from the lower ends of the rice irrigation canals have to some extent ameliorated the extreme low flow conditions experienced in 1920 and 1924, but the steady increase in irrigated area goes on each year. The total quantity of water which passes out of the valley in late summer is slowly but surely decreasing.

There is nothing to indicate any change of conditions in the immediate future. Irrigation has reached nearly stable conditions on the upland areas of the San Joaquin Valley, largely because the streams are nearly developed to their full capacities. On the Sacramento River, however, large areas of fertile land under irrigation systems built to supply them with water are certain to be placed in crop and increase the use of water. The result will be a steady depletion of the stream and an increase of the salt water menace.

Salt water conditions such as have occurred in the lower delta since 1918 have become permanent and will not be improved until some additional water supply is turned into the river during the low flow period, or unless a barrier is built to prevent the approach of salt water from the ocean. It is difficult to conceive a set of natural conditions that would change this situation. We have reason to expect years of heavy runoff to follow the long period of dry years since 1917, but a review of the past does not lead to the belief that summer water supply can be increased to such a point that any appreciable effect will be experienced by the delta region and industrial area.

EFFECT OF SALT WATER ON DEVELOPMENT

The industrial and agricultural areas along the upper bay and lower river region came into being before there was any serious thought of the salt water problem, in other words prior to 1918, for that was the year in which the encroachment of salt water was serious and over a long period of the year. Since 1918 there has been no large increase of cultivated land in the delta region and few new industries of importance have been established in the industrial area. There has been, however, a steady growth in the industries already established.

The effect of salt water upon the various users of water will be discussed in the following paragraphs.

Agriculture. Water to be supplied for agricultural purposes must be free from large quantities of soluble matter. The upper limit of concentration safe for use depends upon the soil, crop, rate at which it has been used, drainage facilities, and to some extent upon whether fresh water is available at other times in the year for leaching purposes. The determination of the safe limit is, therefore, a matter of considerable difficulty, as it will vary as these factors differ.

For the purposes of this report, however, it is fair to assume that water containing 100 parts of chlorine per 100,000, equivalent to 160 parts of sodium chloride or common salt per 100,000, is the upper limit of safety; since the water contains other salts the total salinity of water containing 100 parts of chlorine will vary from 175 to 200 parts per 100,000. Water of this degree of salinity is not safe for use, except where precautions are taken to provide good drainage and to continue leaching the water through the soil so that there is no accumulation of salty matter. Such water may be used with safety on light soils where drainage is good and the use excessive, and is not harmful where used occasionally during late summer. One-half of this quantity, or 50 parts per 100,000, is much safer for use and waters of this degree of salinity could be used with comparative safety.

The records quoted above show that in years of extreme low flow, waters of 100 parts of chlorine per 100,000 will penetrate into the delta region to points beyond Rio Vista on the Sacramento, and to Stockton and beyond the mouth of Middle River on the San Joaquin. During some part of the summer approximately one-half of the delta area will be surrounded by salt water.

This condition has several results: First, it renders questionable the irrigation of permanent crops, particularly such crops as are sensitive to salt; second, it has a tendency through the percolation beneath the levees of sub-irrigating the adjoining land with saline water; third, it reduces the value of lands through the fear of salinity; and fourth, it adds expense and uncertainty to the question of domestic supply, for on most of the delta the river is a source of domestic water.

The net effect of this condition is to render agriculture uncertain in the delta, to reduce the value of land, and to create a menace which will result in the destruction of the land by the accumulation of salts.

AREA OF AGRICULTURAL LAND AFFECTED BY SALT WATER BARRIER

The area of agricultural land affected by the salt water barrier is taken as:

First—The area of marsh land lying practically at sea level.

Second—The area of land up to elevation 150 above sea level; an elevation to which pumping has been carried with success.

These areas may be subdivided into geographic regions as follows:

First—The area around San Pablo Bay, between Carquinez Strait and the site of the San Pablo barrier.

Second—The area around Suisun Bay, that is, from the mouth of the river at Collinsville to Benicia.

Third—The delta area or region upstream from the mouth of the river.

Fourth—Irrigated or irrigable lands above the delta.

San Pablo Bay Area. A large area of marsh land lies along the west and north shores of San Pablo Bay. At present a large part of this area is in process of reclamation. Much of it is growing grain crops or pasture, but little of it is irrigated. The surrounding waters are salty at nearly all times of the year. Fresh water fills the sloughs and bay during flood time, a period becoming shorter each year. Ground water of good quality has not been found and there is little likelihood of its ever being obtained, as deep wells have been drilled in many places.

Much of the land is yet salt and all of it is influenced to some extent by the salt in the bay, and the reclamation by using rainfall alone to wash out the salt is slow. The presence of fresh water surrounding the area would permit much more rapid reclamation and would make it possible to bring into profitable agriculture nearly this entire area.

Surrounding the marsh area is an area of high ground nearly as large, all of which is now unirrigated. This marginal area could be all watered and made available for many different crops by fresh water from San Pablo Bay and tributaries if this bay were kept full of fresh water. Novato, Petaluma and Sonoma Creeks and Napa River all penetrate the marsh lands and extend to high land; they would make fresh water available for the adjoining high ground and enable pumps to supply small units or large, depending upon the physical conditions.

It is to be expected that at some future time all agricultural lands in California will make use to some extent of irrigation water where such is available. Irrigation in the coastal belt has not advanced as rapidly as in the interior valleys, because owners of such land can grow profitable crops without artificial watering. Maximum results can be obtained only by irrigation and it is but natural to expect water to be in demand at some future time.

The San Pablo Bay areas which may at some time become interested in irrigation are all areas where climate and soil are acceptable to agricultural pursuits. The region is close to centers of population; transportion facilities are usually good or easily improved; it is one where increased population is certain. The availability of fresh water in the bay and tidal sloughs will serve to stimulate this growth.

Lands so situated, close to tidal waters and centers of population, are likewise attractive to industries. As the San Francisco Bay region grows, more and more of the territory adjoining the bay will change from agriculture to industrial or residential property. With a water supply attached to it, the change in use becomes easier, for the amount of water required for agriculture supplies the needs of residential or industrial occupation.

Carquinez Strait. Carquinez Strait—7½ miles long—extends from Suisun Bay to San Pablo Bay. High hills with only small areas of flat land bound the strait. The opportunities for extensive developments for use of water in this territory are limited by the topographic conditions. Industries already occupy much of the available territory and the small valleys, particularly in Contra Costa County, are now filled by towns, the population resulting from industrial, transportation and commercial enterprises along the waterfront.

If the strait is filled with fresh water and tidal fluctuations and currents are decreased, the more complete occupation of all available ground will be possible. At the present time growth is restricted by water supply. Martinez, Port Costa and adjoining territory obtain a part of their water from wells at Concord, 12 miles away. The supply from ground water is limited. Large additions to this supply are impractical. The Sugar Refinery at Crockett has barged water from the river or the Marin County shore at great cost for many years.

On the north side of the strait, the town of Benicia has a small water supply but cannot increase this supply very much without great expense.

Suisun Bay Area. Marsh lands adjoining Suisun Bay total 70,000 acres. Immediately adjacent to these marshes is an area of 93,000 acres of higher land suitable for agriculture but not now irrigated. Fresh water in Suisun Bay would make it possible to convert this area of dry land to irrigated areas of high value.

The marsh area of Suisun Bay is all practically at sea level. Much of it is salt marsh or at least contains enough salt to interfere with some kinds of agriculture. A large part has been leveed and utilized for pasture, but with unsatisfactory drainage, and salt has accumulated.

Fresh water in the surrounding tidal channels and freedom from daily tidal fluctuations will permit the leaching of this land and make the reclamation of it practical. The land is inherently fertile and will become very productive when leached of salt. The works to accomplish this are simple in character and the operation is simple and certain of success.

If fresh water is made available, there is little question but that these marsh lands can eventually be made as productive as the delta lands of the Sacramento and San Joaquin rivers further upstream.

The high ground above these marsh areas and which may be watered by practical lifts out of tidal channels includes the lower parts of Green Valley around Cordelia, the lower part of Suisun Valley, now highly developed to deciduous fruits, and the region from Suisun to Denverton.

South of the bay the lower parts of Walnut Creek and Ignacio and Seal Creek valleys may be reached with low pumping lifts. These

valley lands are now in part planted to fruits and the agricultural possibilities of the region have been demonstrated. Irrigation water cannot be obtained for these areas from any other source known at this time. Wells are of small yield and uncertain life. Storage reservoirs on these streams may be possible but none is known except small ones, and these will serve only small local areas.

The most important difficulty is the extremely erratic nature of the runoff from this area. In wet years floods are heavy, but in years below normal precipitation the runoff may be very limited, often negligible. Storage to be dependable must hold water over two or three dry years an impracticable condition for agriculture except in very limited areas. The greater part of the area will remain unirrigated unless some cheaper, more dependable supply of water is made available. A salt water barrier will place fresh water at points where it can be readily obtained by practical developments.

The Delta Region. The delta region, affected by tide levels, extends as far up the San Joaquin River as Duncans Ferry (6 miles below the mouth of the Stanislaus River) and up the Sacramento a short distance above the city of Sacramento. The distance from the mouth of the San Joaquin to the head of tide water by river is 77 miles; to the head of tide water on the Sacramento is 56 miles. Between these extremes are many miles of tidal channels and sloughs affording access by boat to nearly all parts of the region, and by relatively short dredger cuts, making it possible to deliver tidal water at the edge of high ground.

This region includes 376,000 acres of land, either marsh or swamp and overflowed, and 91,000 acres of high ground immediately adjacent to the marsh on the west side of the valleys. These total 458,000 acres.

The entire area is irrigated or irrigable from waters at tide level. The most recent information indicates that of this area 360,000 acres are now irrigated in both deltas. In both deltas an area of 98,000 acres remains to be irrigated, part of which are irrigated and farmed irregularly. The economic status of the farmer has much to do with the area under cultivation.

The Up River Country. The entire irrigated area tributary to Suisun Bay is to some extent interested in the salt water problem. At the present time a suit is before the Superior Court of San Joaquin Valley, between riparian users and appropriators in the delta region and 443 defendants on the streams above the delta. This suit involves nearly all of the large users of water, both for irrigation and power, on the stream. Much other litigation is in prospect. The outcome of this controversy cannot be foreseen but it is impossible to predict anything but serious complications and nearly endless difficulties no matter which turn the courts may take.

Should the outcome of the present suit be that tide water lands have no riparian rights upon waters of the streams, in excess of one-half of the present delta area will be periodically surrounded by salt water. The agricultural industry will be affected and the salt water menace to these lands will become permanent. The final result will be disastrous to a very large area of land which has been the most uniformly productive land in the state. The continued storage and use

of water above tide level and the increase in pumping to high lands around the tidal area will cause salt water to enter the rivers in all years, and at times the greater part of the tidal waters will be contaminated with salt from the ocean.

Should the courts take the view that owners on tidal waters have riparian rights to the flow of the stream, a great deal of very valuable land now using water must release the water which has heretofore been used and a tremendous damage to higher areas will result. The release of waters may affect salt water conditions to some extent but it is impossible to conceive a condition in which enough water will be released to push back salt in years of light runoff.

As is shown later in this report in the chapter on "Storage and Release for Control of Salinity," the plan under which this proposal has been made does not look practical as a means of taking care of the irrigation problem of the delta. Furthermore, it leaves out of consideration the entire industrial area that lies just below the delta.

Power Companies. Two power companies supply the industrial region—the Great Western Power Company and the Pacific Gas and Electric Company. Both companies have an interest in the salt problem in two ways: The market for power is the first and most apparent interest the power companies have in this problem in that the maintenance of the present industries and their growth in the future affect the income of the distributing companies.

In a later chapter a statement of the approximate use of power for industrial and domestic purposes is included. The rate of growth of power sales indicates a steady increase in industrial activities. The more rapidly these factories grow and the more new factories there are installed, the better will be the power companies' incomes. A potential industrial territory offers opportunity for a very large increase in the use of power and the encouragement of these industries is a legitimate function of power companies.

The second way in which these companies are interested is the question of litigation mentioned above. The Great Western Power Company and the Pacific Gas and Electric Company and subsidiary companies, such as the Sierra and San Francisco Power Company and Mount Shasta Power Corporation, are parties to the suit previously mentioned. In addition to them the San Joaquin Light and Power Company and Southern California Edison Company, both developers of power on the San Joaquin River, are included, and the Modesto and Turlock, South San Joaquin and Merced irrigation districts are included on account of their storage and use of water on tributary streams. The interests of these concerns, therefore, are created by the direct attack upon their storage and use of water in the higher watersheds.

Should the outcome of this suit establish the riparian right of the delta land owners, the power companies will suffer very seriously in consequence, by the necessity of either releasing water now stored or condemning the right to continue the practice of controlling the flows.

Fishing Industry. Under present conditions, with the Sacramento and San Joaquin rivers open to the flow of tides, fish have free access from the ocean to the fresh water streams draining the Sierra Nevada

Mountains. Several types of commercial fish are caught in these waters and other fish are important as food for the commercial varieties. There has developed a considerable fishing and fish-canning industry along the bay and lower river shore. The catch in river and upper bay approximates 5,000,000 to 6,000 000 pounds a year—largely salmon, shad and striped bass. (See table.)

The Fish and Game Commission has in charge the maintenance of fishing and the preservation and control of natural fish life, together with the propagation of existing species and the introduction of new forms suitable to these conditions.

Plans for the salt water barrier provide for fishways so that fish may travel upstream. Fish will have free travel at such times as gates are opened and will no doubt pass through the ship locks at all times.

THE FUTURE OF THIS REGION

The future of the industrial region on Carquinez Straits and Suisun Bay depends upon the growth of population. California and other Pacific coast states are growing more rapidly than any other section of the United States. There has been for many years a constant inflow of people from the East and an increase in population along the whole Pacific shore. The cities of Los Angeles, Oakland, San Francisco, Seattle and Portland have grown much more rapidly than is the average growth of American cities.

There is no such rapid development anywhere in the country except the industrial growth in the cities around the Great Lakes, where large manufacturing interests have centered. Aside from the city of Los Angeles, the rapid-growing cities of the country have been the industrial centers. In the case of Los Angeles, the industrial growth has been large but the great increase in population arises, to a large extent, from the attractive climate of this southern city.

Estimates of future population of the San Francisco Bay region have been made by several organizations in studies concerning public utility matters. The results of three such studies are shown in the table following. The first, column I, is the estimate of the population of San Francisco and east bay cities made in connection with studies of trans-bay bridge; column II is an estimate of the metropolitan district, taken as San Francisco, Alameda, Contra Costa and San Mateo counties, by the telephone company; and column III the estimate of population of the East Bay Municipal Utility District by that organization. Each of these estimates indicates that the population will double in about 25 years.

Estimates of Growth of Population

Year	*I. San Francisco and Trans-bay Cities*	*II. San Francisco Metropolitan District*	*III. East Bay Municipal Utility District*
1910		686,873	229,404
1915	760,000		
1920	850,850	891,477	330,348
1925	976,000		
1930	1,100,000	1,329,200	501,000
1935	1,250,000		
1940	1,400,000	1,856,700	702,000
1945	1,577,000	2,172,000	
1950	1,750,000		948,000
1960			1,230,000

I. Estimate of population San Francisco and East Bay cities by Board of Engineers Trans-Bay Bridge, San Francisco, May, 1927.
II. Pacific Telephone & Telegraph Company—estimate by Robert W. Bachelor, includes San Francisco, Alameda, Contra Costa and San Mateo counties, April, 1925. Published in "San Francisco Business" April 17, 1925.
III. East Bay Municipal Utility District, Annual Report 1925, page 7.

Contra Costa County has grown at a more rapid rate than the bay region as a whole. Census figures for the counties around the bay are shown in Table 4. Contra Costa's growth as compared with other bay counties is shown below:

Subdivision of State	*Population 1920*	*Increase 1910 to 1920 Per Cent*	*Increase 1900 to 1920 Per Cent*
State	3,426,861	44	130
Alameda County	344,171	40	164
Contra Costa	53,889	70	198
Marin	27,342	9	74
Napa	20,678	4	26
Sacramento	91,029	34	98
San Francisco	506,676	22	48
San Joaquin	79,905	58	125
San Mateo	36,781	38	204
Solano	40,602	47	69

Recent figures to show increase in population are shown in Table 5, in which are given the school enrollments for years 1915, 1921 and 1927. These are summarized below:

School Enrollment Bay Shore Districts—Contra Costa County

				Per cent increase	
	1915	1921	1927	1915–21	1915–27
Elementary schools	5020	7262	9118	45	82
High schools	510	1037	1586	103	210
Totals	5530	8299	10,704	50	94
Increase		50%	30%		

Population Growth and its Cycles. California, in common with other states, is going through a readjustment of population distribution and kind of occupation. A comparatively few years ago the greater part of our population was engaged in agriculture; today manufacturing and mechanical industries occupy more people than agriculture. In 1920 agricultural pursuits (including forestry) occupied 18 per cent of the wage earners of the state as compared with 28½ per cent engaged in manufacturing and mechanical industries. Today the percentage engaged in manufacturing is higher and increasing all the time.

Students of population growth recognize cycles of growth which, for certain reasons, start slowly, grow rapidly and decline slowly. California has gone through two cycles of growth—mining and agricultural—and is now entering upon a third cycle—industrial.

The gold rush commencing in 1848 caused the first rapid increase of population after California became a part of the United States. As mining gradually declined in importance, agriculture attracted many people and a great increase in population occurred. Agriculture ceased to make rapid growth in 1912 and since that period manufacturing and mechanical trades have been the principal source of increase in population.

There are several reasons for present conditions:

1. Agriculture has been depressed since the deflation period of 1921. Costs are still high and the sale price of products has not entirely recovered. Profits have been low.

2. Land values in California are high. There is no more chance for cheap land. The incentive which caused many to enter agricultural pursuits in the great period of agricultural growth does not now exist.

3. Farming is more and more becoming purely mechanical; the same area of land can be farmed now with fewer men. This releases men for other occupations and reduces the number of men trained in farming operations—the potential buyers of farms.

4. Freight rates increased during the war and added greatly to cost of placing agricultural products in eastern market centers. At the same time the increase in freight has made it practically necessary for many manufacturers to establish branches on the Pacific coast.

5. Since 1900, hydro-electric power and long distance transmission of energy to manufacturing centers have been made practical and cheap, and dependable power for manufacturing has resulted.

6. California, since 1900, has become a large producer of oil. The cheap oil has encouraged manufacturing in many ways.

7. The Panama Canal and better shipping facilities have made raw materials for manufacturing more easily available, and have made it easier to ship products of manufacture to other markets.

8. The climate of the coast region of California has become recognized as being well adapted to manufacturing. The cool weather, uniformity of seasons, freedom from freezing or destructive storms, have attracted workmen and capitalists.

The result of all this is that at present the growth of California lies around industrial centers. We are now living in an industrial age. The future of the state depends largely upon the rate and quality of this manufacturing and industrial growth.

This does not mean that there is to be expected a decline in agricultural activity. On the contrary, the growth of cities and centers of industrial enterprises will stimulate the growth in agriculture. Markets for more farm produce will result from increases in industrial population, there will be a better market for the raw products of manufacture which originate on the farm and the improvements in transportation that will result from manufacturing will benefit agriculture. We may expect the growth in agriculture to continue, but at a rate lower than during the years prior to 1912.

Agricultural Extension Possible and to Be Expected. In the chapter in which the region lying tributary to the upper end of the bay and lower river is described, the statement is made as to the area of land which could be irrigated from fresh water basin above the proposed salt water barrier. These areas are as follows:

Areas Irrigable From Fresh Water Basin Above Barrier

	Marsh	*Upland*	*Total*
San Pablo Barrier—San Pablo Bay	51,000	48,000	99,000
Army Point Barrier—Suisun Bay	70,000	93,000	163,000
Totals above San Pablo	121,000	141,000	262,000
Delta region above mouth of river—			
San Joaquin	257,000	58,000	315,000
Sacramento	110,000	33,000	143,000
Grand totals	488,000	232,000	720,000
Of this area, that above Army Point is	437,000	184,000	621,000

Of this area, approximately 360,000 acres are irrigated in the delta region. The areas around Suisun Bay and on San Pablo Bay are surrounded by salt water for so much of the summer that pasture crops alone are grown to a considerable extent.

Following the history of growth of the country, it is reasonable to expect that all of the areas which can be irrigated from this fresh water basin will be irrigated and cultivated as rapidly as the population and increase in markets warrant. The region is close to markets, well supplied with transportation facilities, which will be both by rail and water, has a climate suitable to a great variety of crops, and it would be only natural that such areas would be put to use.

Industrial Growth to Be Expected. There is no possible way of predicting what increase there will be in the industrial development except that it will be large and substantial in character. There are many basic industrial activities not represented in this part of the Pacific coast—industries that will unquestionably settle in this region when a fresh water supply is assured—and there will be a continued and more rapid growth of the ones already on the ground.

Every large industrial region of the world has developed at points where fresh water is abundant and cheap, and where facilities for handling of raw products to factories and carrying the finished products to markets are well established, and the rates to markets are reasonable. San Francisco Bay, being in the geographical center of the Pacific coast, is the natural point where large factories will locate. The fact that large cities are close at hand, that transportation facilities are established, that power is abundant and cheap where oil pipe lines bring oil from the fields further south, and that the climate is an unusually good one for a manufacturing business, are all important. If there is added to these essential conditions a large fresh water reservoir, there will be no more favorable location for manufacturing. It can be expected that the growth here will be as rapid as in any other part of the country and more rapid than has been true at any time in the past history of the state or Pacific coast.

WATER REQUIREMENTS OF THE REGION

The present water requirements of the region are supplied from many sources. Richmond, on the upper end of San Pablo Bay, is within the East Bay Municipal Utility District, a public organization engaged in the construction of a water supply system from the Mokelumne River. It is to be expected that this district will purchase the distribution system of the East Bay Water Company now serving the territory, and that it will construct such additional facilities as may be required to supply industrial and domestic requirements of the territory. Water from this system will be costly. The charges of the East Bay Water Company average nearly 30 cents per 1000 gallons. Little if any reduction in cost can be expected from the utility district unless a part of the expense is raised as taxes.

The smaller towns, such as Martinez, Port Costa, Benicia, Bay Point, Antioch and Pittsburg, obtain water either from wells or by pumping from the river at fresh water times, or by small storage reservoirs filled during flood or fresh water season. In all of these towns water is high-priced (the average price of water from the Port Costa Water Company is about 27 cents per 1000 gallons), usually of inferior quality

at least some time of the year, and there is no great supply in sight to take care of rapid increase in growth of population. In fact the growth of the territory outside of the Utility District mentioned is to a large extent restricted by its water supply. The Utility District can not serve the industrial plants on account of the high cost of water.

The construction of a salt water barrier will effectively remove this deterrent to growth, for it will place fresh water of good chemical quality alongside of all of these towns, and with the modern methods of filtration and purification the water will be suitable for domestic or any industrial use. The cost of pumping will be a small part of the cost of water from any other known source.

The industries now established between Oleum and Antioch, on both sides of the straits, use 10 million gallons daily and the use is increasing at the rate of a million gallons daily per year. Enlargements and extensions to these plants will probably increase this rate of growth.

Prediction as to the future is hazardous, as much depends upon whether or not a salt water barrier is built. This structure will greatly stimulate growth of present industries and will encourage the establishment of new ones. It is within the bounds of reason to expect 100 million gallons daily to be used by industries within the next 25 years.

Domestic Supply for Cities and Towns. Water for domestic purposes is higher priced in San Francisco and the East Bay cities than in any other large cities of America. This high price results from the difficulty of securing water in quantities sufficient to take care of the rapid growth of these communities. The same thing may be said of smaller cities along Carquinez Straits. Water for domestic use has been difficult to secure, the price is high, the quality is not good at all times. There is no known way by which small communities can satisfactorily grow unless the water supply is ample for the needs of their growing population.

As an example of this condition, the history of the Benicia Water Company may be cited. This company has made a careful investigation of the possibilities of securing water, has drilled wells for underground investigation, has considered storage possibilities in the hills back of the town, and has finally been required to use river water at such times as this water is available, and to supplement this supply with pumps. During much of the year the community is unable to supply water of a good quality without great difficulty.

On the south side of the straits the water supply for towns of Crockett, Martinez and surrounding territory is provided by the Port Costa Water Company, largely from wells in the neighborhood of Concord. Litigation has restricted the extent to which these wells can be utilized and this community will be faced with the very large expense of going to distant points for a water supply if the growth of the towns continues.

The town of Pittsburg is supplied from wells and, at seasons of the year when the water is fresh, from the San Joaquin River. The limit to the availability of underground waters is in sight and Pittsburg will be placed to great expense to secure a water supply if the growth con-

tinues to be as rapid as it has been in the past. Similar conditions prevail at Antioch, where protracted litigation called the attention of the state to the difficulties of this community carrying out its plan of pumping water from the river. Since 1920 Antioch has built a storage reservoir on the slopes to the south of the city, into which fresh water is pumped during the early summer, and stored and used in late summer. The result is that water is more costly and of poor quality for domestic purposes, largely on account of the taste of stored water in open reservoirs in bright sunlight.

The entire industrial areas along Suisun Bay and Carquinez Straits may be said to be restricted in growth on account of the fact that there is no easily obtainable supply of fresh water. The result has been a restricted rate of growth of population and an increase in cost of water to those who are already in the community.

The salt water barrier, to a large extent, will remove these difficulties. If the barrier is located at the San Pablo site, the entire area will be cared for. If it is placed at the Army Point site, the entire region upstream will be on a fresh water lake. The industrial area below the upper end of the straits can then be supplied from a relatively short pipe line heading above the barrier.

The reversal of flow, caused by tides at Sacramento, has endangered the cities' water supply by causing sewage to back upstream. The barrier will prevent this from occurring, as it will raise low water at Sacramento and prevent upstream flow.

SURVEY OF REGION AFFECTED BY SALT WATER

The region affected by salt water includes the area from the lower end of Carquinez Straits upstream to Isleton on the Sacramento River, Wakefield Landing on the San Joaquin, and Mansion House on Old River. It includes Carquinez Straits, Suisun Bay, and approximately one-half of the delta on the San Joaquin and Sacramento rivers. San Pablo Bay is of course affected but salt water is more nearly a natural condition in that body of water. Indirect effects are experienced in all parts of the watershed draining through Carquinez Straits and the Bay region and cities which have commerce with these industrial and agricultural areas. The problem, in fact, is one which interests all of California, for the prosperity of this industrial region and the prospective growth of this country in some measure affect the entire area engaged in agriculture or trade in this part of the Pacific Coast.

The region directly affected by the recent invasion of salt water includes the cities and towns of Oleum, Crockett, Port Costa, Martinez, Bay Point, Pittsburg and Antioch on the south side of the straits and Suisun Bay, and Vallejo and Benicia on the north side. Salt water extends as far upstream as Rio Vista.

The estimtaed population of these towns and outlying territory is in excess of 30,000.

Industries. The important industries located along the Straits of Carquinez and Suisun Bay are as follows:

INDUSTRIES

Carquinez Straits.

Left Bank: *Town*

1—Union Oil Company ..... Oleum
Refining, casing and shipping petroleum products.

2—Selby Smelting & Lead Company ..... Selby
Branch of American Smelting & Refining Co.
Smelting and refining non-ferrous metals.

3—California-Hawaiian Sugar Company ..... Crockett
Sugar refineries, largest in world, 5,000,000 lbs. a day.

4—Port Costa Brick Company ..... Port Costa
Makers of brick, etc.

5—Grain Warehouses ..... Port Costa
Storing, cleaning, shipping—principally barley.

6—Petroleum Products Company ..... Martinez
Petroleum products.

7—Mountain Copper Company ..... Martinez
Copper smelting and refining, fertilizers.

8—Shell Oil Company ..... Martinez
Refining and shipping petroleum products.

9—Southern Pacific Company .....
Operating railroad and ferries.

Right Bank:

10—Mare Island Navy Yard ..... Vallejo
Repairs and construction of naval ships.

11—Sperry Flour Company ..... Vallejo
Milling of wheat and other grains.

12—Benicia Barracks and Arsenal ..... Benicia
U. S. Army stores.

13—Kullman-Salz Tannery ..... Benicia
Leather.

Suisun Bay

Left Bank: *Town*

1—Associated Oil Company ..... Avon
Refining and packing for shipment petroleum products.

2—Coos Bay Lumber Company ..... Bay Point
Manufacturing and wholesale lumber; large storage 75,000,000 F. B. M.

3—Pacific Coast Shipbuilding Company ..... Bay Point
Ship building—steel and iron products.

4—General Chemical Company ..... Nichols
Large manufacturers of heavy chemicals.

5—San Francisco & Sacramento Railroad Company .....

Most Important from Pittsburg to Antioch:

6—Booth Cannery Company ..... Pittsburg
Canners of fish, fruit and vegetables.

7—Hickmott Cannery Company ..... Pittsburg
Fish, fruit and vegetables.

8—Paraffine Company ..... Pittsburg
Paper board.

9—Great Western Electro Chemical Company ..... Pittsburg
Diversified heavy chemicals.

10—Redwood Manufacturing Company ..... Pittsburg
Redwood pipes and tanks and other products of redwood.

11—Columbia Steel Company ..... Pittsburg
Steel products.

12—Pioneer Rubber Company ..... Pittsburg
General rubber products.

13—H. W. Johns-Manville Company ..... Pittsburg
Magnesium and asbestos building specialties.

14—Santa Fe Railroad Company .....

Industries in Richmond and along the shores of San Pablo Bay are as follows:

Left Bank—Below Carquinez Straits:	*Town*
1—California Cap Company Caps for detonating high explosives.	Stege
2—Stauffer Chemical Company Bulk chemicals from crude ores.	Stege
3—Metropolitan Match Company Matches.	Stege
4—Pullman Manufacturing Company General shops, repairs and construction of cars.	Richmond
5—Santa Fe Railroad Company General shops, repairs and construction of cars.	Richmond
6—Standard Sanitary Mfg. Company Porcelain and enamel plumbing fixtures. Distribution of other porcelain and enamel ware.	Richmond
7—Certainteed Products Company Roofing and paints.	Richmond
8—Republic Steel Package Company Metal containers, principally drums for oil and gasoline.	Richmond
9—Standard Oil Company Refining and shipping of petroleum products.	Richmond Point
10—Philippine Refining Corporation Refining copra and other vegetable oils.	Richmond Point
11—California Wine Association Formerly largest winery in world; industrial alcohol.	Winehaven. Richmond Point
12—Giant Powder Company Dynamite and other explosives.	Giant
13—Hercules Powder Company Dynamite, T.N.T. and other explosives.	Hercules

The majority of these establishments along the Straits and Suisun Bay produce large outputs of material and are in the class ordinarily called "heavy" industries. They produce products essential to modern life both in peace and war times. Steel, iron, petroleum products of all kinds, chemicals, fertilizers, powder and fuse, leather, brick and tile, flour and feed, lumber and lumber products, ships and boats, sugar, fish and canned goods are produced in very large quantities.

A survey of the plants between Oleum and Antioch shows an annual production in 1927 of products valued at $250,000,000. The increase in annual output is large and the growth has been regular. The first large factory to establish in this territory was the Sugar Company in 1907. The period up to 1920 was an active one in growth, but since salt water troubles became so prominent only one new plant of large size has located here.

Freight in and out of this district by rail and water, directly attributable to these plants, approximated 14,000,000 tons in 1927. Three railroad systems serve the territory. Vessels, both river and ocean-going, handle much freight. Oil pipe lines from the fields in the San Joaquin Valley deliver oil to the refineries, to large tank farms for storage, and to vessels.

Expenditure for electric power by these industries was $800,000 in 1927. Electric power is furnished by the Pacific Gas and Electric Company and the Great Western Power Company. The use of power increases every year. Power rates are the same as in the Bay cities.

In 1927 these plants employed on an average of 8500 persons, the annual payroll amounting to $15,000,000. Comparatively little sea-

sonal employment is found—most of the factories run fairly constantly through the year. The population depndent upon the factories, using a ratio of 4 to 1, is 34,000.

The industrial territory on San Pablo Bay below Oleum, in Contra Costa County, is nearly as large as the district described above. If the entire waterfront area in Contra Costa County is considered, we find the annual products to be $515,000,000; the number of employees to be 17,000; the annual payroll $29,000,000.

The industries between Oleum and Antioch now use 10,000,000 gallons of water a day. The annual increase is 10 per cent, or a million gallons a day. All of this water is pumped from tide water level when there is fresh water in the stream, but some of the factories use wells during the salt water period. Draft upon the ground water is causing a change in the quality of many wells by drawing in salt water. There is a definite limit to the amount of water which may be drawn from underground sources, and it is apparent that this limit has been reached.

Factories engaged in the production of large quantities of "heavy" products ordinarily locate where fresh water is abundant and can be had at the cost of pumping. New plants seldom locate under any other conditions and when there is a choice between localities, the one where water is abundant and cheap is selected, providing the other factors which control locations are the same. There is only one place on the coast of California where such conditions existed in the past—the upper bay and lower river country. Industries now located there expected to obtain water by pumping direct from tide levels, and the change brought about by the invasion of salt water has added to expense of operation and has discouraged increase in plants which involve increased use of water.

There is great need of restoration of the favorable conditions of fresh water which formerly existed in this region. New industrial establishments will be attracted by abundant fresh water. If California does not provide such facilities, northern cities will offer greater inducements and many industries will locate Pacific Coast branches in these northern cities. There are in these other states large areas of land where pure, fresh water is abundant and may be had for the cost of pumping from permanent lakes or streams.

Rates for water in California cities are higher than in the north, as is shown in the following table:

Cost of 500,000 Gallons of Water Per Month

San Francisco	$157 56
Oakland	161 71
Los Angeles	72 16
Stockton	54 50
Portland	44 11
Seattle	32 94

The recent disaster to Los Angeles' St. Francis Dam will probably result in an increase in water rates in that city. Proposals have been made to increase the base rate from 5 cents per 100 cubic feet to 18 cents. If this proposal is carried into effect the rate for 500,000 gallons in the above table will be nearly $120.

Hardness of water is another factor in which northern cities have an advantage over the public supplies in California cities. Hardness is undesirable in water for either domestic or industrial uses—in some classes of industries hard water must be treated before use.

The comparison below will show the relative hardness of public water supplies of Pacific Coast cities:

Hardness in City Water Supplies

Hardness as Calcium Carbonate, Parts Per Million.
(From Water Supply Paper 496)

	Maximum	Minimum	Average	
San Francisco	166	83		
Oakland			181	Reservoir and wells.
Stockton			560	Wells.
Sacramento			60	River.
Los Angeles			163	Owens River.
			251	Los Angeles River.
Portland, Oregon	22	6	9	
Seattle, Washington	33	14	23	

The supply of Sacramento approximates the hardness of water that will be retained above a salt water barrier. The quality of water reservoired above the barrier will be better than any other city supply in California shown.

Hardness may be partly removed from water in modern purification plants. At Columbus, Ohio, water with average hardness of 272 parts per million was reduced to 97 parts at a cost of treatment of 2.45 cents per 1,000 gallons. (Proceedings of American Society of Civil Engineers, February, 1928.)

One of the needs of California today is a fresh water reservoir around which factories can be located with assurance of a permanent supply of pure water. Probably no single accomplishment in the construction program now under discussion will do more toward the general progress of the state. More factories mean greater population and more local markets for agricultural produce and amelioration of the general level of prosperity of the state.

A salt water barrier at San Pablo or Army Point will remove the obstacle now deterring the location of new industries in this region. It will remove the cause of added expense to the present plants and will encourage their more rapid growth.

Besides great quantities of water, large industries require cheap power, efficient transportation facilities, both by rail and water, and a good climate attractive to labor. The lower river and upper bay region lack only water. The salt water barrier will supply this single deficiency. If the barrier is not built, California, without doubt, will lose many important factories.

Shipping Interests. San Francisco Bay and the rivers drained through Carquinez Strait are used by boats engaged in river and bay traffic as well as ocean-going vessels. At the present time there is a large amount of river and bay traffic between Stockton, Sacramento and numerous delta landings and the cities around the bay. During parts of the year the river traffic extends beyond Sacramento and upstream from Stockton. Ocean-going vessels land at Carquinez Strait points, Bay Point, Pittsburg and intermediate ports. Traffic by water is on the increase.

Tables 6, 7 and 8, in this report, give the tonnage and value of freight carried by water.

Projects for the improvement of navigation above Carquinez Strait have been approved by congress and the work of acquiring rights of way in preparation for dredging is nearly completed. Two projects have been approved: First, the dredging of the channel through Suisun Bay to provide 26 feet of water for navigation purposes through this bay, and second, the Stockton deep channel which will provide 26 feet of water to Stockton.

Projects for deepening and regulating water depths for Sacramento River navigation are under consideration. A system of dams for controlling levels at low flow has been proposed, though not yet adopted by act of congress. The present project provides 7 feet of water to Sacramento, 4 feet to Colusa, and with provision for 3 feet as far upstream as Chico Landing. Practical navigation upon the upper San Joaquin is now limited to the head of tide water, though if the project of the state for canalization of the San Joaquin under the "Coordinated plan for development of water resources" is carried out, navigation will be practical to points far above any places recently reached by boats.

Water transportation is available to all of the islands and reclaimed lands in the delta region, and nearly all of the agricultural produce grown in this country is shipped to market by boat.

Tides, currents and salt water phenomena in the upper bay and lower river region are important to shipping interests for several reasons: First and foremost is the fact that the presence of salt water has retarded growth and, if continued, will decrease the agricultural productivity of this region. Second, and no less important to shipping interests, is the fact that the industrial region along Suisun Bay and Carquinez Strait is held back in its natural growth by the menace of salt water. The water-carried tonnage in and out of this industrial area is large and is on the increase. The completion of the deep water channel will give a stimulus to commerce by water.

The natural result of a salt water barrier would be to increase very rapidly the industrial territory and there would be, in consequence, much more freight to be moved, a larger population to be served, and a tremendous increase in shipping. The effect will be noticeable on both bay and river boats and upon ocean-going traffic.

The plans for a salt water barrier provide for locks so that vessels may have uninterrupted access to the fresh water basin above the barrier. As discussed later, the Young report considers thoroughly the shipping business and the plans provide for locks of at least two sizes—one for small vessels and the second for large vessels. Locks are designed to provide for future increase in traffic, both in size and amount of traffic and depth of drafts.

Tides and currents now cause a loss of time to the shipping interests and necessitate special provisions and greater care in the handling of vessels, particularly in the rapid currents in the Carquinez Strait region. A barrier will provide for a constant water level above the structure except during periods of flood, which will reduce the currents to one direction only, and that downstream, and will facilitate the movement of vessels by reducing the time now consumed by bucking adverse currents. The ability to dock without currents is an additional value to ships.

It is generally agreed by navigation interests that there is some benefit in sea-going vessels docking in fresh water, in the destruction of growths of salt water which cling to the bottoms of the vessels and reduce their speed. Ocean-going shipping entering the fresh water basin above the barrier will have the benefit of this condition.

Sediment carried by the river waters into Suisun and San Pablo bays adds to the difficulties of navigation and causes annual expenses in its removal. Debris from hydraulic mining is one of the principal sources of such hindrances to navigation. The rivers which enter Suisun Bay bring to salt water each year a portion of the debris deposited in stream channels in years of unrestricted mining. From the best information available, it is probable that the peak of movement of debris has passed out of the rivers and is moving through Suisun and San Pablo bays en route to the ocean.

What effect the salt water barrier will have on the movement is important from the standpoint of navigation interests. Studies which furnish information on the problem have been made several times in the past twenty-five years. The brief statement below discusses these investigations.

In 1906 the writer, then in the employ of the United States Reclamation Service, made a study of the sediment carried by many important streams in the west. The results are in part published in Water Supply Papers Nos. 274 and 237. The investigation had in part the determination of the amount of sediment carried in streams that might be lodged in storage reservoirs. At the time this study was undertaken, experimental work was carried on to determine methods of field and laboratory work. Sampling apparatus was designed and tested to permit the collection of samples at any depth. The use of this apparatus indicated that the problem resolved itself in two phases—suspended silt and sand rolled along the bottom. The suspended silt was found to be very fine and to remain in suspension a long time. It is moved as the water moves and in the tidal portions of the stream remains in suspension during the tidal movements.

Samples collected daily during 1906, a 125 per cent run-off year with heavy floods, gave an average silt content (weighed for flow) of 64.5 parts per million by weight or, for silt weighing 80 pounds per cubic foot, 0.081 cubic yards per acre-foot. In 1908, a 67 per cent run-off year, the average silt content was 85 parts per million by weight or 0.106 cubic yards per acre foot. The total suspended silt in 1906 was 2,300,00 cubic yards; in 1908 it was 1,550,000 cubic yards.

The greater part of this material continues in suspension until the bay is reached, where slow currents permit a part of it to drop to the bottom. Flocculation from salt water to some extent encourages the deposition.

A salt water barrier will have the effect of improving conditions as affected by the deposition of the suspended silt. Fresh water above the barrier will remove the effect of salt water flocculation above the structure and there will be a greater tendency for the silt to be carried lower than under present conditions. As it is now, the flocculation commences in Suisun Bay or at the first point where fresh water and salt water mix. Eighty per cent of the sediment is carried in the flood months, at times when the barrier gates will be opened and the current

above the barrier is highest. In these periods the tendency will be for sediment to be carried through the barrier with less deposition in Suisun Bay than under natural conditions.

Below the barrier, where fresh and salt water mix, there will be the same tendency for deposition and flocculation that now exists, the only important difference being the decreased tidal movements due to the barrier. There is no reason to expect any great change in conditions from those now found. Sediment moves to a large extent in flood periods, so that any accumulations which are deposited in low flow periods or in years of light run-off are swept away in flood years. Fine sediment which enters the streams probably will not greatly change in amount in future years, as the fine materials originating in former hydraulic mining operations are on the decrease. Storage reservoirs on the headwaters will tend to trap sediment and further reduce the load that will arrive at tide waters. On the whole, the barrier will probably benefit rather than harm the navigation interests so far as it affects suspended silt.

Sand and coarse debris rolled along the stream bottom make up an important but unknown part of the total stream load of sediment. Estimates by the writer, made in 1905, indicated that the equivalent of from 10 to 20 per cent of the suspended load was carried along the bottom. In a recent study of silt in the Colorado River (U. S. Dept. of Agriculture Technical Bulletin No. 67), the estimate is made that in that stream 80 per cent of the silt is in suspension and 20 per cent carried as bed load. Though the actual quantity may be in doubt, there is no question but that the stream bed at Sacramento and below has been lowering in recent years—an indication that the burden of debris from the old hydraulic mines is decreasing.

Sand and gravel along the stream bed do not move at ordinary flows but only when the stream is in flood. The barrier, therefor, will have little or no retarding effect upon the movement of sediment carried along the bed, for in times of flood the flow in all practical consideration will be unobstructed and the downstream velocity wil be practically the same as without the barrier. The bed load will move as it now does, or at least will move as it would if the barrier were not present.

Structures in Water. The teredo and other varieties of marine life which destroy wood have been noticeably active in San Francisco Bay and adjoining waters since about 1914. Prior to that time all wharves, docks and other structures in water in the upper bay country were built of untreated piles and the lives of the structures were very long. About 1914 the teredo became active and in the dry years which followed 1917 practically all wood structures in water below Antioch were destroyed. The Marine Piling Committee estimates that $25,000,000 damage was done in this period. Of this sum several million dollars represent damage in the territory upstream from Richmond. Here the invasion of the teredo is encouraged on account of the encroachment of salt water. In earlier periods fresh water was present each year long enough to prevent wood-destroying animals establishing themselves.

Many of these structures have not yet been replaced. Those which have been replaced have been largely of creosote or other treated piling at an additional cost over untreated timber. No form of treatment

gives permanent protection but reduces the activities of boring animals and lengthens the life of timber.

The cost of structures built of timber is, therefore, greatly increased over what it was prior to the invasion of salt water in the upper bay. Where concrete is used an additional increase in cost also occurs, for concrete to be placed in sea water has to be of much better quality that concrete suitable for fresh water conditions. The ordinary mix of concrete for sea water contains approximately two-thirds of a barrel of cement per cubic yard in excess of that considered good quality for fresh water conditions. On this account alone concrete work costs at least $2.00 a yard more due to the salt water invasion.

Under the present conditions, all future structures to be erected in this region must be built to resist teredo and other boring animals and salt water. The increased cost of wharves, docks, bulkheads, and all similar structures in water, will approximate 20 to 25 per cent more that if fresh water were present. The construction of a barrier to prevent the encroachment of salt water will greatly simplify such construction work and will reduce the cost under present conditions.

Corrosion of Pumps, Piping and Equipment from Salt Water. Steel and iron are corroded more rapidly in brackish or salt water than in fresh water. Experiments indicate that unpainted steel or iron lasts from two to ten times as long as fresh water as in brackish or salt water. This means that all gates, pipes, pumps and other parts of structures in water, or in industrial establishments where water is used, must be pointed frequently or they will corrode more rapidly, require more frequent replacement, and cost more to operate than where fresh water is present. In the large industries, such as oil refineries, steel mills and plants where large amounts of cooling water are used, this becomes a very important factor.

Accurate estimates of the cost of salt water due to corrosion alone are difficult to make. Mr. C. W. Schedler, of the Great Western Electro Chemical Company of Pittsburg, California, estimates that there is a minimum of three million dollars' worth of equipment located in the plants between Crockett and Antioch being seriously depreciated by the presence of salt water. The normal life of this equipment is twenty years, or a depreciation of $150,000 a year. Mr. Schedler estimates that the salt water conditions of 1924 caused a depreciation twice as fast as ordinarily. The loss between Crockett and Antioch in that year is a cash loss of $150,000.

Conditions nearly as bad as 1924, so far as these industries are concerned, occurred in 1920 and again in 1926, and in each of the years between there is some increase in corrosion from salt water. Conditions in the future offer little promise of improvement, and the probability is that unless a barrier is constructed the present industrial plants alone, without consideration of future extensions or new plants, will suffer an annual loss from salt water in excess of that experienced in the past.

Estimates by the writer in the territory from Oleum to Antioch, on both sides of the channel, indicate a loss from salt water corrision in excess of that made by Mr. Schedler. The writer is of the opinion that the average annual loss approximates $300,000 a year in the plants now operating.

Railroads. The natural and most feasible direction of travel north to south is across Carquinez Strait for both vehicular and rail traffic. At the present time all railroad transportation is handled by boats. Four lines of boats carry freight and passengers across this waterway. A year ago the first bridge was built—that across Carquinez Strait—for vehicular traffic only.

The Southern Pacific Company, the greatest railroad system in California, has studied a plan of bridging Carquinez Strait for many years. It is understood that a more active study of this problem is now going on than in any time in the past, and that prospects are good for the railroad to carry out such a development.

The San Francisco-Sacramento Railroad, which crosses the channel near the upper end of Suisun Bay, at one time acquired a permit to build a bridge at this point. The traffic carried by the company did not warrant such a heavy expenditure at that time, but recently the control of this road has been acquired by the Western Pacific Railroad Company, and it is likely that a large development of this transportation company will take place in the near future.

Any barrier built to hold back tide water can be easily arranged to act as a bridge for rail and vehicular traffic. In the Young report, a part of which is quoted later, estimates of the cost of providing such a barrier with a bridge are given.

Two applications have been recently filed with the county board of supervisors of Contra Costa County for a bridge permit across the bay region in the neighborhood of Richmond, the estimated costs being from $9,000,000 to nearly $20,000,000.

Should the barrier be built at San Pablo Point, it can serve there all present and probably future transportation needs. A barrier in Carquinez Straits, either at Army Point or Dillon Point, will be available for rail transportation, and when the present bridge facilities are outgrown it may be used for vehicular traffic.

Mr. Herbert Benjamin, of the Southern Pacific Company, stated before the Joint Legislative Committee on April 16, 1928, that his company had made plans for a bridge between Bulls Head and Army Point, and that the cost, including approaches, was estimated to be less than $10,000,000. The bridge was designed to give clearance of 70 feet. Application for permit had not been formally made to the War Department.

The site selected for this bridge is one of the sites investigated by Young, and any bridge built for the railroad would prevent its use as a site for a salt water barrier. It is highly advisable that full consideration be given of the barrier problem before any bridge permit is let for this location. The barrier can be made to serve as a bridge and the advantages of the double use are apparent. If the barrier is built to accommodate both rail and vehicular traffic and a proper allowance made for this service, the net cost to other interests can be lowered. This phase of the question is discussed later in this report.

Ferries. The ferry from Benicia to Port Costa, now operated to care for vehicles, could be replaced by a barrier at Army Point or Dillon Point. The ferry now operating from Richmond to Point San Quentin could readily be replaced by a barrier at San Pablo Point. This slow method of crossing the water barrier can be replaced by a modern bridge, with little delay in traffic and with cost not greater than the

present ferry charges. The automobile registration in California is on the increase and travel across the straits will be greatly stimulated by a bridge. There is no certain method of determining this quantity.

Local Shipping. The tonnage and value of local shipping on the Sacramento and San Joaquin rivers are given in attached tables. It will be seen that there has been a nearly constant increase in freight, except during the period of, and following, the World War. At present 2,100,000 tons, of a value of $140,000,000, are carried yearly.

The increase in shipping which will follow the construction of a barrier against salt water will benefit local shipping. As shown elsewhere, the advantages of the barrier will offset the disadvantages, and on the whole greatly benefit shipping.

Ocean-borne Traffic. Ocean borne traffic is varied, though lumber and petroleum products make up the greater part of the business. The tables attached show the volume of business in Suisun Bay to be about 2,500,000 tons, valued at over $40,000,000; for Carquinez Straits 4,000,000 to 5,000,000 tons, valued at $100,000,000 to $150,000,000; San Pablo Bay, 4,000,000 tons, valued at over $60,000,000.

Increases in ocean-borne traffic will follow the building of a barrier and completion of a deep-water channel to Stockton. The stimulation to industrial production will greatly increase traffic for all classes of vessels. Ocean shipping will benefit by the ability to dock in fresh water without the menace now caused by tidal currents. Fresh water tends to cleanse ocean vessels of growths which retard movement.

The menace to shipping in passing through locks is so small that no additional insurance is charged to vessels which use locks. The safeguards to navigation, now provided around locks, greatly reduce the danger in using them. Periods of fog are the times of greatest difficulty. The removal of ferry traffic across the straits at Benicia will probably offset the dangers due to navigating through locks in foggy weather.

SOLUTIONS OF THE SALT WATER PROBLEM

Several solutions of the salt water problems may be suggested:

1. Salt water barrier.
2. Storage and release.
3. Fresh water brought in by conduits or pipes.

The first is the only complete and the most satisfactory method of solving the problem. The Young report best describes the barrier and its effects upon the territory.

The Young Report. Mr. Walker R. Young, Construction Engineer, U. S. Bureau of Reclamation, has written a "Report on Salt Water Barrier—California, Below the Confluence of Sacramento and San Joaquin Rivers." This report is dated August 27, 1927, and was made by the U. S. Bureau of Reclamation in cooperation with the California State Department of Public Works, Division of Engineering and Irrigation, and Sacramento Development Association.

The report consists of a volume of 405 pages of discussion and descriptive matter, a volume of 592 pages of exhibits and tabulations, a portfolio volume of drawings and diagrams, and three volumes giving records of borings at various sites. The work described in these volumes extended over a period in excess of three years, or from January, 1924, to the date of completion.

A large amount of field work was done as a basis for office studies. The investigations include all problems that affect the construction or operation of the structure.

In his report Mr. Young describes in detail the various investigations he has made concerning the salt water problem. He presents sixteen preliminary designs and estimates with three alternatives "in order that they may be readily available in the economic study which is considered necessary in the final determination of the feasibility of the barrier." He made "no attempt to study the economic aspect of the problem other than to enumerate the advantages and disadvantages, as such a study was not considered within the scope of this (his) report." The report, therefore, is an engineering study of the barrier so far as concerns its physical feasibility.

The report determines what kind of a barrier should be built to accomplish its purpose, and presents a large amount of data to show its bearing upon various activities which will be affected by it. Four sites were investigated and the merits and objections to each are set forth in detail, but no final recommendation as to a site is made.

The following quotation from this report gives in condensed form the essentials included therein:

"SUMMARY OF RESULTS

"*General.* The studies made lead to the conclusion that it is physically feasible to construct a salt water barrier at any one of the sites investigated, but at great expense; and that it will be effective in controlling the salinity of the reservoir impounded above it. Not only will it protect the delta and industrial plants along the shores of the bays, but its construction will result in the conservation of a large part of the fresh water required to act as a natural barrier against invasion of water under present conditions.

"Without the barrier, salinity conditions will become more acute unless mountain storage is provided to be released during periods of low river discharge to act as a natural barrier against invasion of salt water. The amount estimated as necessary to act as a natural barrier was in excess of the flow in the Sacramento River above Red Bluff in 1924, and Red Bluff is located above the points of diversion of water used in irrigating the Sacramento Valley.

"The sites selected for development by drilling are considered geologically satisfactory for the type of structure proposed. Although preliminary designs and estimates are presented for four sites, there are only two general plans involved. A barrier, if constructed at the Army Point, Benicia, or Dillon Point site, would create a body of fresh water in Suisun Bay and in the delta channels, while a barrier at the Point San Pablo site would include San Pablo Bay as well.

"*Type of Dam Proposed.* The type of structure to which principal consideration is given is one in which the ship locks and flood gates are located at one side upon rock foundations, the closure of the present waterway being effected by means of an earth and rock fill dam to be brought up to its designed height after completion of the ship locks and flood gate structure. In another type studied the flood gates form the closure between concrete piers sunk to bed rock foundations in the present waterway by the open caisson method. Both types have been

designed with and without provision for carrying a railroad and highway.

"The passage of floods is probably the most important problem since it involves the safety of the delta levee system. It would be desirable, if practicable, to provide gate area equivalent to, or slightly in excess of, the present waterway area in order that conditions of flow might remain unchanged, but the accomplishment of this plan would be very costly, if not altogether infeasible.

"In the design of the structure, advantage is taken of the difference in the elevation of water surface which it is possible to create above and below the barrier to discharge flood water. On account of the fluctuating head, resulting from tides on the downstream side, the discharge through the flood gates will vary from a maximum at low tide to a minimum at high tide. The reservoir above the barrier, therefore, will function as a basin in which the river discharge in excess of the flow through the flood gates at high tide is stored to be discharged at a rate in excess of the river discharge during low tide.

"The flood gates are of the Stoney roller type with sills depressed to 50 or 70 feet below sea level in order better to control the salinity of the water behind the barrier as explained in Chapter IX. In operation, the gates would be raised clear of the water surface as required to allow free passage of the floods. As the flood receded the gates would be lowered, one at a time, as necessary to maintain the water surface above the barrier at any predetermined elevation.

"The requirements for passing vessels through the barrier is an important consideration irrespective of where it might be located, but particularly, if located below Mare Island Navy Yard. In the designs proposed, ship locks have been provided in number to care for considerable growth in water-borne commerce, and in size to pass the largest ships likely to navigate the waters above the barrier.

"In some of the designs for the Army Point site, the ship locks would be constructed away from the flood gates, which, of course, would be advantageous for shipping during the passage of great floods from the rivers, but these are rare and considerable study would be required before it could be determined whether the advantage thus gained would offset the advantage of having the large salt water sump adjacent to the ship locks where the salt water entering the fresh water reservoir through the locks could be caught and returned to the salt water side. It is possible that the design with the ship locks and flood gates separated would be even more efficient in controlling salinity, but this is doubtful. The plan at the Army Point site in which the structures are separated interferes least with the plant of the Mountain Copper Company and results in economy otherwise.

"In the designs including a railroad and highway bridge across the locks these have been placed at an elevation to permit a large proportion of vessels using the locks to pass underneath without opening or lifting the bridges. In one design at the Dillon Point site, the clearance is made sufficient to pass large ships without the necessity of moving bridges. Adequate clearance will be more important 25 years hence than at present on account of the increase to be expected in commerce.

"A fish ladder is provided in one of the ship lock walls and provision is made for relieving salinity above the barrier by pumping salt water from that side in an emergency. The design of the structure is discussed in Chapter IV.

"*Estimated Cost.* Following is a table showing the estimated cost of the barrier at each of the sites investigated. It should be noted, particularly, that the estimates for the Benicia site are based upon assumed foundation conditions since the site was not developed by drilling as were the other three sites. No attempt will be made to analyze the costs, as such an analysis would be quite involved and of no particular value. Conclusions as to the desirable plan can be arrived at best by balancing the estimated costs against the features of the design as shown on the general plans referred to in the table, and to other drawings contained in Volume IV. Estimate No. 13 is unique in that Carquinez Straits, for its full width, is taken advantage of in providing an extra large flood gate area, and the railroad and highway bridges are placed at the elevation required to avoid the necessity of lifting bridges to allow the passage of vessels.

"The preliminary estimates are believed to be conservative. Refinements in the final designs will undoubtedly result in reduction of quantities. All construction materials are readily available in large quantities and can be brought to any of the sites investigated by rail or water. Large manufacturing plants, foundries and machine shops are located nearby, all tending toward low unit costs. The estimates of cost are based upon present prices of material and labor. Should these change materially it will, of course, be necessary to make adjustments in the estimates.

"The benefits to be derived from the construction of the barrier are believed to be commensurate with the cost but an economic study of the situation must precede the adjustment of the cost of the barrier for the reason that so many interests will be directly affected—beneficially or otherwise. The true value of the project can be determined and a decision reached as to who should contribute to the cost thereof only after such a study has been completed.

"*Tides and Floods.* The most critical condition to be met is a combination of a large flood from the rivers, a storm on the ocean tending to pile up the water driven through the Golden Gate in the bays, and an unusually high tide. An analysis of past floods leads to the conclusion that provision should be made for the passage through the barrier of not less than 150,000 second-feet.

"According to computations made the effect of a barrier of the type proposed at the Army Point site would be to raise the water surface immediately above the structure 0.7 of a foot with a discharge of 750,000 second-feet. The effect would be felt less at the mouth of the rivers as a result of the smoothing out of irregularities by the reservoir created. The studies indicate that if a 750,000 second-foot flood from the rivers should coincide with a tide reaching the maximum height records at Army Point in 1909, but otherwise similar to the high tides of January 24 and 25, 1914, the elevation of extreme high water (8.5 feet above mean sea level) at Collinsville, computed by the flood control bodies of the state, would not be exceeded.

"It is probable that the rise in water surface at Collinsville, due to a barrier at the Point San Pablo site with equivalent gate area, would be less than if located at the Army Point site, but it would not be safe to reduce the gate area at Point San Pablo for the reason that extreme tides through the Golden Gate are more effective near the gate as evidenced by the fact that the tide of November 18, 1918, at Presidio, was 0.7 feet higher than that of January 25, 1914, at which time the maximum elevation of water surface at Suisun City was reached.

"At the Army Point and Dillon Point sites the ship locks are considered effective in passing extremely large floods, but they are not considered available at the Point San Pablo site because of the greater necessity for keeping the locks open to navigation at that site, even during great floods.

"The effect of a barrier at the Army Point site would be to reduce the tidal volume passing the Golden Gate by less than 8 per cent in comparison with about 35 per cent if it were built at the Point San Pablo site. The occurrence of frequent high tides in the bays due to piling up of water in them as a result of storms on the ocean would be to elimininate through construction of a barrier at any one of the sites investigated. The effect on the elevations of tides below the structure would be to raise them slightly according to the U. S. Coast and Geodetic Survey.

"*Navigation and Bridge Traffic.* Any plan for the control of salinity involving the construction of a dam across the bay or river channels must be coordinated with the requirements of navigation.

"Ship locks are provided in number and size to meet the requirements of the present and immediate future. Provision for ultimate traffic at the time the barrier is constructed does not seem necessary since flood control on the upper rivers will improve to permit the replacement of flood gates by ship locks as the need for them develops. A summary of the operation as it would have occurred on July 6 and 7, 1925, is shown in Table 6-33.

"Although railroad and highway bridges are contemplated in most of the designs they are not regarded as indispensable and are omitted in some anticipation of indifference on the part of railroad and highway interests toward the opportunities afforded by the barrier. In the studies made it is considered that traffic over them is subject at all times to the convenience of navigation. The bridges are designed to give a vertical channel of 50 feet above high water when in the lowered position and 135 feet when raised. The interruptions to bridge traffic, as they would have been on July 6 and 7, 1925, are summarized in Table 6-40.

"An examination of Plates 2-3 and 2-4, showing depths in San Pablo and Suisun bays, will indicate the limitations placed upon commerce under present tidal conditions. If the elevation of the water surface above the barrier were maintained at about 2½ feet above mean sea level, a constant depth equivalent to that at mean high tide under present conditions, would be obtained. Uncertain and varying tidal currents would be eliminated above the barrier and they would be reduced in velocity below. The maintenance of a permanent water level would not only be convenient for navigators, but would be a material benefit to owners of wharf property above the barrier.

"The farther downstream the barrier is located the more it will interfere with shipping. Locking requirements can be satisfied with least expense at the Army Point site and conditions are most unfavorable at the Point San Pablo site.

"The construction of a barrier at the Point San Pablo site probably would be looked upon with disfavor by the Navy Department for the reason that it would restrict free navigation through San Pablo Bay to the Mare Island Navy Yard by the necessity of passing war vessels through ship locks. This objection does not apply to the Dillon Point, Benicia or Army Point sites.

"*Storage in the Delta Channels and Bays.* For convenience the calculated storage in the tidal prism above each barrier site, between elevations—3.6 and+6.4 U. S. G. S. Datum (0 and 10, U. S. Engineer Datum) has been summarized in Table 7-2, Volume II.

"*Silt.* The problem has been attacked with the idea that any structure that would be detrimental to San Francisco Harbor would be looked upon with disfavor by those in jurisdiction. The investigation has not definitely determined the effect of a barrier upon silting. Conclusions must, therefore, take the form of conjecture until studies more comprehensive than it was possible to make in this investigation have been completed.

"The construction of a barrier at any one of the sites investigated may possibly have a beneficial effect upon the Golden Gate bar rather than detrimental. The movement of silt toward San Francisco Bay will be checked by the construction of a barrier at Army Point, Benicia, or Dillon Point. A beneficial effect upon the Pinole Shoal will result through the construction of a barrier at Army Point or Point San Pablo. The effect upon Pinole Shoal of a barrier at Dillon Point is at present indeterminate, as is also the effect on silting in San Francisco Bay of a barrier at Point San Pablo.

"Whether the scouring action of the tidal current tends to maintain or destroy fixed channels in the bay system remains to be determined. Should shoaling occur it will be comparatively small in amount and the channels can readily be maintained by dredging, perhaps with less effort and expense than without the barrier. Dredged material pumped into the marshes would build them up and improve their fertility.

"*Salinity.* In years of normal river discharge there is no salinity problem in the delta. It is menacing for a few days in the fall only but, considering the marshes surrounding the upper bays and the towns and industrial plants along their shores, the encroachment of salt water presents a serious problem almost every year.

"Conflict between irrigation interests in the upper valleys and in the delta region never will occur in years of large run-off for the reason that in the development of storage the construction of expensive reservoirs to hold the excessive run-off from the drainage area, occurring only once in a number of years, will not be practicable even though sufficient reservoir sites in which to store all of the run-off were available.

"The introduction of salt water into the fresh water lake through the ship locks can not be prevented but means are provided for drawing

off this salt water and thereby controlling the salinity of the water up-stream from the barrier.

"Leakage of salt water past the flood gates, although comparatively small in amount, can be prevented by maintaining the water surface above the barrier at a higher elevation than below.

"Deep gates, opening from the bottom, are essential to the successful operation of the barrier for dependence is placed upon them as a means of drawing off the heavier salt water which seeks the deep holes and channels, and for flushing out the reservoir above the barrier.

"Unless fresh water is available for occasional flushing, the reservoir above the barrier will gradually become salty. Flushing can be accomplished quite readily if water is available for that purpose. The studies of water supply, although based on meager data, indicate that in normal years there will be from eleven to twelve million acre-feet available for that purpose. In years of deficient water supply there will be little, if any, fresh water available for flushing and the reservoir above the barrier may have to hold over one or more years without flushing.

"*Return Flow.* Return flow will increase with irrigation development in the upper valleys with the result that the salt menace in the delta will be alleviated; but, even though the return flow should increase to the 3500 second-feet estimated to be sufficient to act as a natural barrier against encroachment of salt water, the demand for water will be such that it could not be used for that purpose unless it is replaced by water from mountain storage.

"*Control of Salinity by Storage in Mountain Reservoirs.* Salinity in the delta can be controlled through construction of storage reservoirs in the mountains from which water could be released during the season of low river discharge in the amount necessary to act as a natural barrier against invasions of salt water. Mountain storage would be a temporary expedient for the reason that, ultimately, there will be use for all of the available flow from the rivers, and the discharge into Suisun Bay and thence to the ocean, of water sufficient to act as a natural barrier against salt, would be an economic waste. However, storage created in mountain reservoirs constructed mainly for other purposes might be used for some time to control the salinity in the upper bays and delta channels during development of the requirement for full use of the reservoirs for the purpose for which they were primarily constructed, thus deferring the large investment in the salt water barrier.

"*Teredo.* The factor of salinity is one of fundamental importance in the distribution of teredo. The average lethal salinity for teredo navalis, the species to be feared most in the upper bays, has been determined experimentally as 5 parts per 1000; therefore, if the water above the barrier is maintained at a concentration below the limit for irrigation use teredo can not exist there.

"*Fish.* Fishing industries above the barrier, if constructed, should not suffer for the reason that, even though the fish ladder, which is an integral part of the structure, should fail to function, the fish would not be prevented from entering the fresh water reservoir because they would have free access to it through the ship locks which, under normal conditions, would be operated many times throughout each day and night.

"*Sewage.* No investigation was made of the effect of the barrier upon sewage, but from investigations made elsewhere it appears that fresh water will be better adapted for receiving sewage than either salt or brackish water since, gallon for gallon, fresh water disposed in a normal manner of more sewage than salt water. It will be best, in this respect, to keep the water above the barrier fresh because the intermittent admission of salt water interferes with bacterial, animal and vegetable growths that effectively aid in taking care of and digesting sewage.

"*Use of Water in Operation of the Barrier.* The seven main sources of loss of fresh water accompanying the operation of the barrier are evaporation from the water surface of the reservoir created; water required for the operation of the ship locks; leakage around the flood gates; water used in operating the fish ladder; and water to supply the requirements of industries, municipalities and possibly irrigation. With the exception of losses past the flood gates and through the fish ladder, which are constant for the same type of structure, the losses increase as the barrier is moved downstream and this factor has an important bearing upon the selection of a site.

"Owing to the increasing difficulty of maintaining the reservoir created by the barrier free from salt water as the water surface is permitted to fall, and because of navigation requirements, it probably will not be advisable to allow the water surface to fall below mean sea level. Likewise, because of the nature of the delta levees and the cost of drainage in that region by pumping, the ultimate maximum allowable water surface for periods of several months' duration may be fixed at 4.0 feet above mean sea level, although later developments may show that this maximum storage level can be increased to 5.0 feet.

"It is not necessary to decide at this time at what elevation the water surface above the barrier should be maintained. To begin with, it should be held at, or a little below, ordinary high tide level. As time goes on the elevation may be raised as experience dictates.

"Water drawn from the fresh water lake for irrigation, domestic and industrial uses, as well as that required in the operation of the ship locks, should be replenished from river flow or mountain storage with the idea of maintaining a constant depth of water for the navigable waterways effected by construction of the barrier. In years of extreme low run-off the water surface could be drawn down to the elevation of mean sea level, or possibly, in an emergency, to the elevation of mean lower water.

"As the water surface behind the barrier is lowered, the cost of maintaining the Delta levee—not considering floods—should become less; the cost of pumping water out of the lake for any use becomes greater; the cost of pumping seepage water would become less; the difficulties of keeping the lake fresh would increase; and the depth of navigable channels affected would become less.

"Ship locks are provided in various sizes in order to economize on the use of fresh water and to prevent entrance into the fresh water lake of larger volumes of salt water than necessary by requiring vessels to use the smallest lock which will accommodate them. Intermediate lock gates are added for the same reason.

"Economy in the use of fresh water in the operation of the ship locks can be effected through the adoption of lock gates divided horizontally at a depth to allow a large portion of the vessels having a shallow craft to pass through the locks without opening the lower half of the gates and it is assumed that this type of construction will be adopted. It is estimated that the resulting annual saving of fresh water, based on an average daily traffic as it was on July 6-7, 1925, would be:

Army Point site	173,000 acre-feet
Dillon Point site	146,000 acre-feet
Point San Pablo site	295,000 acre-feet

it being assumed that the water surface above the barrier would be maintained at an elevation 2½ feet above mean sea level.

"It will be necessary to flush the reservoir, preferably once each year, to rid it of accumulations of brackish water resulting, principally, through the inability to trap all of the salt water finding its way into the fresh water reservoir from one source or another. The amount of fresh water required can not be predicted with any degree of accuracy but a study was made of the amount of fresh water available for the operation of the barrier, based upon the assumption that storage in the mountains was well developed. The study is based upon meager data but the results are believed to be indicative.

"From Table 10-13, it is evident that if the maximum height of water surface in the reservoir is restricted to 2½ feet above mean sea level, the water stored in the reservoir thus formed will not be sufficient to operate the barrier at any of the three sites studied during the irrigation season, even in years of heavy run-off, and it will be desirable, therefore, to seek the highest practicable elevation at which to maintain the storage level.

"The shortage due to lack of reservoir capacity increases as the barrier is moved downstream, although the capacity of the reservoir is greater. This is principally due to the greater evaporation, and to the larger requirements of navigation, industries and municipalities.

"As the storage elevation above the barrier is raised the amount of water available for flushing in years of low run-off is decreased. According to Table 10-13, no water would be available in the season 1923-24 for flushing out the reservoir created through construction of a barrier at the Point San Pablo site whether water were impounded to elevation +2.5, +4.0 or +5.0. It appears that, in any case, there would be no flushing water available in 1923-24 if water were stored to elevation +5.0, although in a normal year there would be a large amount available for flushing, regardless of where the barrier is constructed or of the elevation at which the water surface above the barrier is maintained.

"If the above analysis is correct, it may be concluded that since one of the principal objects of the salt water barrier is to conserve fresh water, it will be desirable to maintain the largest practicable storage capacity above the structure. Likewise, it is evident that the farther downstream the location for the barrier is chosen the greater will be the quantity of water required for operation, and the greater will be the shortage during seasons of low run-off. Since the shortage must be

supplied from mountain storage in order to maintain sufficient depth for navigation, and to hold the water level at an elevation where the reservoir will not be deluged with salt water whenever the ship locks are opened, it is apparent that consideration of the necessity for conservation of water would require the selection of one of the upstream sites—Army Point, Dillon Point or Benicia, if the latter, upon investigation, is found to be suitable structurally."

Discussion of Young's Report. The summary just given of Young's report gives his main engineering conclusions. As will be seen, the engineering conclusions are as follows:

1. The construction of a salt water barrier is feasible at either San Pablo Point or at one of three sites near the upper end of Carquinez Strait.

2. The barrier can be utilized for both rail and automobile traffic.

3. The cost will depend upon the method of construction. A barrier can be built at Army Point with bridge of 50-foot clearance for $49,800,000; at Benicia for $46,200,000; at Dillon Point for $44,700,000; at Point San Pablo for $75,200,000.

4. The barrier will pass a flood of 750,000 second-feet (larger than any flood measured into Suisun Bay) with an estimated raising of water surface of 0.7 of a foot at the barrier, at Army Point, and about 0.55 of a foot at Collinsville. Water levels in the delta under extreme conditions are estimated to be below elevations of high water computed by Flood Control Engineer of the state. With a barrier at Point San Pablo, the raise in water level would be slightly less than at Army Point.

5. The barrier would effectively handle both water transportation through locks and bridge transportation.

6. The barrier would store fresh water and prevent the encroachment of salinity now taking place every summer.

7. The barrier will prevent teredo from working above its location.

8. The barrier can be operated so as not to be a detriment to the fishing industry.

9. The elevation at which water is maintained above the barrier in summer has not been determined. To begin with it should be held a little below ordinary high tide. This point is discussed in more detail in the following pages.

10. Young makes no determination of the economic features of the barrier, nor does he recommend a site.

Two things in connection with Young's conclusions may be given further consideration: first, that return seepage will increase in quantity and ameliorate conditions in the delta, and, second, that water from the Sacramento river may be temporarily carried across the delta for use in the San Joaquin valley by releasing stored water and without the construction of the salt water barrier.

With reference to the first matter, it has been shown that return seepage in the San Joaquin valley is being recaptured by the pumping plants on the west side of the valley and there is now no benefit from the return seepage to delta lands in late summer. There is no prospect for increase in return flow, in fact the increase in pumping from wells all over the valley and new pumps along the river will decrease that flow.

In the Sacramento valley similar conditions prevail. It is not certain that return seepage on this stream has reached a maximum, because a large area of land close to the river is not yet regularly irrigated. When this land becomes more intensively farmed, it is to be expected that it will utilize to a great extent this very return water and decrease the net amount which reaches the tidal waters. Return flow, therefore, cannot be depended upon, in either river, to improve salt water conditions in the delta.

As to the second matter, it may be said that so long as the tide ebbs and flows there will be the opportunity for salt water to penetrate the delta, just as far or farther than was the case in dry years since 1917. In 1920, 1924 and 1926, salt water went beyond Three Mile Slough, the principal connection between the Sacramento and the San Joaquin deltas. If water were drawn up the San Joaquin, there would be a greater tendency for salt water to penetrate the delta and be drawn southward. It should be remembered, too, that in dry years released water from storage reservoirs is going to be very difficult to deliver past the large areas of riparian lands. The flow of the rivers will undoubtedly be so low that tides will carry salt water beyond Three Mile Slough. Certainly no dependence can be placed upon this method of carrying water across the delta. The barrier is essential to prevent tidal movements and the encroachments of salt water.

ELEVATION OF WATER ABOVE BARRIER

Objection, from owners of delta land, has been raised to the proposal by Young that levels above the barrier might eventually be raised above mean high tide in order that more water might be stored for use by the towns, irrigated area and industries around the lake above the barrier.

Mr. G. A. Atherton, who is probably as thoroughly acquainted with the delta region as any other person, is authority for the statement that a level of 6.0 feet U. S. E. D. (or 2.4 U. S. G. S.) continuously maintained in summer months is as high as can be safely held against the delta levees under present conditions. According to him, to carry water higher would endanger the levees, would increase seepage and pumping, and therefore add greater maintenance cost to the delta land owner. It should be understood that Mr. Atherton has reference to the delta lands where peat predominates.

The answer to this argument is that the delta lands will be surrounded by salt water unless the barrier is built, but the barrier can, and should, be operated so as to do no damage to these peat areas.

There is some uncertainty as to the exact difference between the datum of the two surveys (U. S. G. S. and U. S. E. D.) and the level of tide as indicated by tide tables. U. S. G. S. elevations refer to mean sea level and are based upon a number of years of observation. U. S. E. D. levels are based theoretically upon mean lower low water but practically are taken as 3.6 feet lower than the U. S. G. S. levels. Tide gage levels are theoretically based upon mean lower low water but practically are referred to the elevation of a point on the Presidio tide gage staff in San Francisco. As near as can be determined, the U. S. E. D. and tide table datum planes are not the same, but the U. S. E. D. datum is about 0.63 feet lower. This figure is not exact, however, and for practical purposes it may be assumed that the two are the same. In the delta region the tidal range varies more in different

parts of the delta than this variation between the two systems of measurement.

If water is held at 6.0 U. S. E. D., it will be at less than high tide in the central delta. Here the tide rises to over 7.0 feet two or three times a year, and in times of southwest storms it has risen to over 8.0. In 1907, during the flood, the elevation exceeded 10.3. With water held at 6.0 there will be no menace to levees and comparatively little increase in pumping out of seepage water. Furthermore, this elevation will permit the efficient operation of the barrier, for salt water is higher than 6.0 at the Golden Gate less than one per cent of the time, excluding storm and flood periods.

Any increase in height should be made only if it can be done without menace to the island levees. In storm periods water will be held lower than would naturally occur except in the most extreme floods. Reservoirs which have been constructed on nearly all tributaries of the Sacramento and San Joaquin rivers will undoubtedly have the effect of reducing the peaks of floods, and there is little likelihood of a repetition of the extremes experienced in 1907, at least such extremes will occur less frequently.

On the whole, the delta lands will be better off with the barrier than without it. The one factor of slightly increased pumping with the summer level held at 6.0 will be more than overbalanced by the freedom from the present menace of salt water.

SELECTION OF SITE FOR BARRIER

Mr. Young in his report sets forth the conditions surrounding the locations investigated as sites for the barrier. The following statement compares the two locations—the three sites investigated near the upper end of Carquinez Strait being treated as one:

Water Supply. Tables attached give the estimated quantities of water required for all uses above the barrier. The quantities here given are estimated uses when all area above the barrier is developed and are liberal figures, with an allowance for flushing to remove salt water let in by ship locks and leakage. The figures show that under these conditions the requirements for the full year are:

Point San Pablo	2,024,000 acre-feet
Army Point	1,160,000 acre-feet
Difference	864,000 acre-feet

For the irrigation period May to September, inclusive, the requirements are:

Point San Pablo	1,236,000 acre-feet
Army Point	638,000 acre-feet
Difference	598,000 acre-feet

The large difference comes principally from the quantity of water required to operate locks and the increased evaporation in the lower site. In other words, from six to eight hundred thousand acre-feet are required to supply the additional unavoidable losses from evaporation and ship lockages in San Pablo Bay.

In the matter of cost, Young's estimates show for a barrier with 50 feet of clearance the following:

Point San Pablo	$75,200,000
Army Point	49,800,000
Difference	$25,400,000

The convenience to other interests is of great importance. The Mare Island Navy Yard is located above Point San Pablo but below Carquinez Strait, naval officers will object to the barrier. On account of the greater number of vessels which pass San Pablo than through the upper end of Carquinez Strait, there will be less objection to the upper site.

Barriers at both sites will serve as bridges. The San Pablo location will replace a ferry now in operation—the upper site in Carquinez Strait will serve both for rail and vehicular traffic and will replace two ferries.

The opportunity to combine the barrier with the Southern Pacific railroad at Port Costa should not be overlooked. The railroad company is contemplating the construction of a bridge to replace the present ferry. If the Army Point-Suisun Point site is selected by the railroad, the barrier can not be built on this site. In some respects this is the most attractive site and until final determination is made of the location, no permit should be given for a bridge across this place.

STORAGE AND RELEASE TO CONTROL SALT WATER

This method of solving the salt water problem has been suggested in several recent publications of the Department of Public Works. Examination in detail of the proposals shows that "salt water control" means the supplying of water of less than 100 parts chlorine per 100,000 to the delta lands. Emmaton on the Sacramento and Jersey Island on the San Joaquin are the limits of control and no suggestion has been made that it is practical to release water to supply Antioch or any of the lower industrial area. This, in fact, leaves out of consideration the area now most seriously damaged.

Studies by the Division of Water Rights based on records including the year 1925 show that to control salinity below 100 parts chlorine per 100,000, the combined flow of the Sacramento at Sacramento and San Joaquin at Vernalis (both points about the head of tide water in late summer) must exceed the following figures:

For control at	*Cubic feet per second*
Emmaton and Jersey Island	3500
Antioch	5000
Collinsville	5500
Oakland and Antioch ferry	6000

These quantities will depend to some extent upon the months preceding the period when control is desired and will, of course, vary with the diversions below the points of measurement. Furthermore, storage of water above tide level will affect the matter by limiting the distance salt water is forced downstream by spring floods.

To effectively supply these quantities of water will require very large storage capacity in dry years.

In 1924, storage in excess of a million acre-feet would have been required to control salinity at the Oakland and Antioch ferry and 370,000 at Emmaton and Jersey. In 1926 over 500,000 acre-feet would have been required at the Oakland and Antioch ferry and 200,000 acre-feet at Emmaton and Jersey. Storage in large amount would be needed about half the years at Emmaton and Jersey and every year for control at the Oakland and Antioch ferry.

The above is under the assumption that storage and diversions in these two valleys do not increase. As shown earlier, this condition has already been violated, for there has never been such increased activity in building storage reservoirs as in the period since 1924. Many reservoirs are planned for construction in the near future. Furthermore, diversions increase every year. Estimates of the quantities required for storage control must therefore be continuously revised upwards.

Release of stored water, to control salinity, will occur in dry parts of the year and to the greatest extent in dry years. To effectively control the right of storage and release, all riparian owners below the reservoir must agree to the arrangement. As the law now stands, the use of such a reservoir may be enjoined and it will be impossible to prevent, except through litigation, the riparian owners from diverting the released water. This difficulty can be removed by condemnation of rights along the stream. The problem looks too large for human accomplishment in any reasonable time and at any reasonable cost.

To one acquainted with water problems in California, it does not seem reasonable to expect that in the dry part of a dry year a flow of 5000 or more feet per second would be allowed to pass pumps and ditches, under which crops were suffering, in order that salt water could be pushed back into the ocean.

As to the cost of storage reservoirs to accomplish the release for salt control, there is little definite information which permits a comparison of costs. The following statements are of some interest:

Kennett Reservoir is proposed by the State Department of Public Works as a unit in the "Coordinated Plan." (See Bulletin 13, Department of Public Works, 1928.) The recommended reservoir capacity is 2,940,000 acre-feet; the estimated cost of dam and rights of way is $55,000,000; of power plant $25,000,000; a total of $80,000,000. With allowances for prior rights, mean annual irrigation yield of reservoir will be 2,858,000 acre-feet. In minimum years the deficiency would be large; 19 per cent in 1920, 42 per cent in 1924. If this reservoir were depended upon for salinity control, the entire available supply would be needed to control salt water at the mouth of the river, leaving no water for the area depending on this reservoir for irrigation. In other words, the very year when the reservoir is most needed it would be of little practical use. Furthermore, Kennett is not practicable unless operated to generate electric power. If the water is held and released for salt water control, the power value is greatly decreased.

Iron Canyon Reservoir is proposed as a secondary unit in the "Coordinated Plan." (See Bulletin 13 of Department of Public Works.) The recommended capacity is 1,121,900 acre-feet; the estimated cost of dam and power plant is placed at $26,000,000; the canal system to utilize this water is estimated at $30,000,000. The reservoir may be utilized in controlling salinity. To quote from the above mentioned report, page 115:

"Sacrificing the power features at Iron Canyon dam would, with other construction unchanged with the exception of the arrangement of outlets through the dam, supply a reserve storage of 364,600 acre-feet of water in Iron Canyon Reservoir to overcome, or alleviate, the salt

water menace in the delta region should such be desirable. Such use is not advocated, but it is demonstrated that there are possibilities along this line."

Should the irrigation feature likewise be disregarded, Iron Canyon would provide a net annual irrigation draft of 800,000 acre-feet or just about enough water to control salt water as low as the mouth of the river—provided the water could be carried past head gates and pumps on its way to tidal waters. Under this condition the power feature would be sacrificed to a larger extent. It is difficult to picture a dry year when water and power are both scarce, in which it would be possible to release a large quantity of water, disregarding its best use for power, and have the the riparian and appropriative users of water along the hundred and fifty miles of the Sacramento River permit this flow to pass by uninterrupted to tide water. The plan does not look practical.

Other reservoirs may be used for the same purpose, that of increasing the flow to control salt water. For example, a reservoir on Feather River has been suggested, another on the American at Folsom. Both of these reservoirs will have value for power development and that value will be greatly reduced if a large quantity of water is held for saline control. The most practical suggestion is in connection with a reservoir on Dry Creek, north of the Mokelumne, the water to be diverted from the Mokelumne River. The rights obtained by the East Bay Municipal Utility District for storage in Lancha Plana Reservoir practically eliminate this reservoir from consideration.

In connection with the proposal for storage and release of water, it should be remembered that the State Department of Engineering has made the suggestion as a temporary expedient, with the expectation that permanent relief would be brought about by the construction of the salt water barrier. This state of affairs would leave the delta lands dependent on a temporary right to be replaced by a permanent right which would be arranged for at some later time. With the growing condition of California and the certainty that the temporary supply will be invaded by increased diversions, this is a very precarious water right, not one which will satisfy the delta land owners. Furthermore, the plan does not consider users below the delta, either towns or industries.

New industries will not be attracted by any temporary improvement in water conditions. Some permanent solution must be reached. It is important to California to have the decision made at once so that the great industrial expansion now going on can be located to a maximum extent in this state.

WATER FROM OUTSIDE SOURCES

Water may be brought in from outside sources to supply the towns and industries along the Straits and Suisun Bay. It is not likely that the agricultural lands can be reclaimed by any outside source of water on account of the high cost. But for the uses of towns and factories it is possible to secure outside water.

Under present conditions water can not be drawn at any point on tide water without either running the risk of getting salt water or of interfering with rights already vested. It may be possible to pump during the fresh water period into reservoirs and to pipe the water thus

stored along the waterfront, supplying both domestic and industrial consumers. Reservoirs of good size are available in the Montezuma hills north of Suisun Bay and a few small reservoirs are found on the south side of the bay. No estimate has been made of the cost of this method. Surveys beyond the scope of this report would be required. It is known that the cost would be large, though cheaper than any other known source.

Other possible outside sources are:

Eel River—A supply which has been suggested for both San Francisco and east bay cities. The distance to Carquinez Strait is 125 miles. Harroun estimates the cost at $22,000,000 to carry 50,000,000 gallons daily to south sides of Carquinez Straits.

Conn Valley—A small tributary to Napa River with probable yield of 10,000,000 gallons daily. Cost not known but the supply would only furnish a part of present needs and would provide nothing for future growth.

Putah Creek—A tributary of Sacramento north of Dixon. Cost not known. About 50 miles north of Suisun Bay. Complicated with riparian claims. All storage at considerable distance in mountains.

Mokelumne or Cosumnes—Drainage Sierras north of Stockton. Cost unknown. Early rights conflicting. About 75 miles distant.

Pumped water from San Joaquin Valley—It has been suggested that the irrigation districts in the San Joaquin Valley could deliver pumped drainage water into the river to be pumped out above salt water limit and delivered to industries and towns along the bay through pipe lines.

East Bay Municipal Utility District—The main pipe line of this district parallels the bay shore from Antioch to Bay Point. To secure water from it the area must enter the district. The district has voted $64,000,000 to complete a 60 m.g.d. supply. Water will be costly if the entire cost is collected from rates, and there is little incentive for Contra Costa County and towns to enter this organization. The water is too costly for the heavy industries, such as now are located along the waterfront.

All of these sources are so distant and costly that the supplies are more of the nature of domestic supplies than of cheap industrial water supplies such as are required in any large and growing industrial region. None of them solves the salt water problem as affecting construction along the waterfront and none of them can possibly be made available for agricultural industries on the bay lands.

THE BARRIER AS A UNIT IN THE STATE COORDINATED PLAN OF WATER CONSERVATION

A plan for the development and use of all waters of the state upon a coordinated plan has been presented in part to the Legislature of the State Department of Public Works. This plan provides for the storage and utilization of all water required in the Sacramento Valley and the transmission of excess water to the San Joaquin Valley for use on lands for which insufficient water can be supplied from local sources. The salt water barrier is a necessary unit in this plan, for water can not be carried through the delta with tidal flow bringing salt water in and out of the channels twice a day.

GENERAL DEVELOPMENT OF BAY REGION

The entire bay region is interested in the salt water problem in that the prosperity of the region immediately concerned affects the prosperity of the cities. The industrial territory along Carquinez Strait is essential to the well being of the whole state. The industries are fundamental to modern civilization. Oil, gasoline, lubricants, steel, fertilizers, sugar, leather, timber, soda, chlorine, fire-proof roofing, paper board, brick, tile, flour, mill feed, and the remaining varieties of manufactured products are necessities of modern existence. To have them abundant and cheap is greatly to the advantage of modern society.

Many of these factories would be classed as nuisances if located in a large city, on account of the odors. Carquinez Strait and Suisun Bay have regular winds which prevent a serious nuisance in this locality. Other communities are not so fortunately situated.

The ratio of factory employees to population of towns is about 1 to 4. This means that the population of the towns immediately surrounding the industries will grow as the industries thrive. This population in towns makes a market for the products of the cities and the multitude of manufacturing establishments which have located in the cities. The heavy industries in turn furnish raw material for use in the factories in the cities.

As a result of this interlocking of interests, the large cities of the bay region have a direct interest in seeing a salt water barrier established. Behind it, around the fresh water lake thus created, there will grow up a thriving community engaged in the production of essential materials which could not be produced within the cities themselves.

CALIFORNIA NOW IN THE INDUSTRIAL AGE

California is now in an age of industrial growth. Approximately one-third of the people of the state are engaged in manufacturing and mechanical industries as compared with less than 20 per cent engaged in agriculture, forestry and animal husbandry (the next largest class of workers). The present growth of the state is due largely to the activity in industrial matters.

Students of population growth recognize cycles of increase in population. There seems to be a definite limit to the number of people that can be reached in any set of circumstances. The growth of California very well illustrates three cycles of growth. In the early days of the state, mining was the attraction and the whole life of the community centered around the mines. As mining reached its climax in the seventies, agriculture came to the forefront and there was a continuous growth on this account. The agricultural era lasted until about 1915. In the meantime, through the discovery of oil and the unprecedented development of the electrical industry, cheap power was made available and manufacturing began to grow. At present there is very little actual increase in agricultural population but a large increase in industrial activities. So far as it is possible to see in the future, our growth will be industrial. Agriculturists have learned to grow more crops with less man power and there is comparatively little likelihood of any large increase in agricultural population. The problems of the state are nowadays to a large extent those of the people of the towns and cities and industrial areas.

DISTRIBUTION OF BARRIER COST

Several interests should share in the cost of this barrier. As has been shown, conditions now existing have been brought about by developments on the higher parts of the watershed, an area covering 32,000 square miles. The bay cities will be contributing to the salt water problem by diversions which they propose to make out of the watershed. The agricultural interests through both valleys are using fresh water in such a way as to contribute to the salt water troubles of the delta lands and the industrial territory. The power companies through use of water in the watershed also affect the problem, and in addition these companies are interested in the increase and prosperity of the industrial region. Other public utilities in this region have the same interest in its prosperity.

The problem is so large and its interests so widespread that it may be said to be state-wide in scope.

The federal government, through its control of navigation, as well as its general interest in the prosperity of the country, is likewise interested in the problem. The California Debris Commission and the River and Harbor work under the Chief of Engineers of the Army already are engaged in river improvement and in control of reclamation work so far as it affects navigation. It would appear reasonable, therefore, to have participation in this construction work by the federal government.

Local interests which will receive direct and tangible benefits from this barrier, such as the towns, cities and lands which can use water directly from the fresh water lake above the barrier, should contribute to the cost of the structure. The delta lands so far as they divert water from tide water levels should also be included in the area contributing because of benefits.

Railroads and vehicular traffic utilizing the barrier as foundation of a bridge should pay the value of this service. It seems reasonable that railroad and vehicular traffic could reasonably contribute a large sum for the use of the bridge.

It appears from examination of Young's estimates that the sum of $45,000,000 will complete a barrier with a bridge at a point near the upper end of Carquinez Strait. A detailed economic study should be made to determine the proportion of the cost that should be borne by each interest involved.

SUMMARY

1. Carquinez Strait marked approximately the boundary between salt and fresh water under natural conditions.

2. Prior to diversions for irrigation, Suisun Bay was brackish in late summer, and salt water may have penetrated as far as Antioch, but only for a few days at a time in years of lowest run-off.

3. If the water now diverted for irrigation and held in storage were released, natural conditions would again be brought about.

4. The dry year of 1918, in which the urge of war had encouraged heavy plantings of rice and other crops in the Sacramento Valley, resulted in penetration of salt water into the delta for a longer time and to a greater distance up-stream than ever known before.

5. Examination of available information shows that the yearly increased diversion of water, which had been going on since irrigation commenced in the valleys of California, had been gradually affecting

the movements of salt water. This slow effect was hardly noticed until 1918.

6. Irrigation and storage are not solely responsible for the influx of salt water. The load of hydraulic mining debris deposited in the streams draining the Sierra Nevadas is a minor factor in the problem. As the sediment moves down-stream the tidal prism is changed and the movement of water is affected.

7. Leveeing and reclamation of marsh lands, around the bays and in the delta region, have had a slight effect upon tidal movements. The net effect of leveeing marsh land has been to decrease the tendency of salt water to flow up-stream.

8. Leveeing of basin lands and diversion of floods through by-pass channels has had an important effect in sending floods rapidly to tide water and in reducing the late-summer flow of water, which under natural conditions was stored and slowly released from basins.

9. Dredging, particularly in lower portions of the rivers and in the navigation channels of San Pablo Bay, has increased the tendency for salt water to flow up-stream. Dredging in Suisun Bay and in the deep-water channels to Stockton may have the same tendency. All increases in channel depth and in straightening of approach have a tendency to increase up-stream flow of salt water, though a quantitative estimate of this tendency can not be made.

10. Irrigation now diverts the entire low flow of all streams entering the San Joaquin Valley. The only flows reaching tide water in late summer and early fall are return waters—seepage from irrigation.

11. Pumping plants on the west side of the San Joaquin Valley, lifting water to the west side slopes, now divert more water during late summer than enters tide levels from the river. The San Joaquin delta under present conditions is dependent in late summer of dry years on flow from the Sacramento River. Additional pumping plants are being installed and there will be a greater tendency in the future than in the past for salt water to flow up-stream into the delta channels.

12. Irrigation in the Sacramento Valley in late summer diverts practically all the flow of streams entering the valley floor. The flow of the river at Sacramento, the head of tide water, is now largely return seepage or waste from canals. The low flow at Sacramento was 500 second-feet in 1920; 2750 in 1921; 3200 in 1922; 3100 in 1923; 705 in 1924; 2760 in 1925; 1330 in 1926; and 3420 in 1927.

13. The area irrigated in the delta of both rivers is now 360,000 acres. The quantity of water used by this land has not been determined with any accuracy. Comparing crops and other conditions affecting use of water, it is probable that the annual consumption approximates $1\frac{3}{4}$ acre-feet per annum. Twenty per cent of the annual amount is used in the summer months of greatest evaporation. At this rate the consumption of water by the delta area is at the rate of 2100 second-feet in the summer. This exceeds the flow into tide water by the river in all years of low flow.

14. Records of salt content of the water have been collected by the Division of Water Rights since 1917. The area of delta land surrounded by salt water (100 parts chlorine per 100,000) at high tide is shown in the following table:

Year	Approximate stream flow before diversions in per cent of normal	Area in delta surrounded by salt water—acres
1924	24	169,000
1925	74	8,500
1926	53	58,000
1927	100	5,000

15. Contrary to popular opinion, the period since 1918 has not been one of stagnation in irrigation development. A number of large storage reservoirs have been built and placed in operation since then. Of approximately 4,000,000 acre-feet of storage reservoirs on streams draining through Carquinez Strait, 55 per cent, or 2,725,000 acre-feet, have been built since 1920. Diversions of water, particularly on the lower San Joaquin River, have increased.

The area under irrigation has steadily increased in both valleys. In 1926 it is estimated that 1,250,000 acres were irrigated in the floor of the valley, with 3,900,000 acre-feet of water by diversions from streams draining toward Carquinez Strait. If mountain valleys and lands irrigated from wells are included, the total area irrigated is probably over 1,750,000 acres.

16. Further extensions of irrigated area are being planned in both valleys. Within the next five years the bay cities will have diverting capacity of about 185 second-feet and will control 431,000 acre-feet of storage reservoirs. These enterprises will tend to increase the salt-water menace. There is reason to expect the same menace of salt water as occurred in 1920, 1924 and 1926 to be present every year.

17. Salt water will penetrate the lower delta region every summer under present conditions. The distance water will flow up-stream will depend less and less upon the flow of streams into the valleys as the increase in use of water continues. About one-half of the delta is likely to be menaced any year. The area may extend beyond this line.

18. There is now no legal control of diversions, other than by the slow and costly process of litigation, except upon a few small tributary streams where the Division of Water Rights has completed adjudications. Litigation between lower users of water in the delta and upper riparian users and appropriators has been in progress for several years. Other litigation may be started. The legal processes are so slow, cumbersome and costly that little result is to be expected for many years, if ever.

The outcome of present litigation will be disastrous if the courts uphold the contentions of either of the parties to litigation. If the delta lands have riparian rights to the waters, a large area of land will have to release water, and storage reservoirs constructed by power companies will be decreased in efficiency and value. On the other hand, if the courts decide that riparian rights do not attach to lands on tide water, the delta will be further menaced by salt water and there will be grave danger of permanent injury to a large area of land.

19. The engineering study of a salt water barrier made by Walker Young of the Bureau of Reclamation, in cooperation with the Department of Public Works of the State of California, concludes that the construction of such a barrier is feasible. Investigations were made at three sites—Point San Pablo, Dillon Point and Army Point. The esti-

mated cost of the barrier with and without bridges is given in the table on page 60.

20. This barrier will maintain a fresh water reservoir free from tidal fluctuations and currents other than these caused by the flow of river water toward the sea. The level of water up-stream of barrier will be maintained at the highest practical level. Young estimates this level at elevation 2.5, U. S. G. S., or 6.0 on tide gage. It is probable that this height of water will be controlled by conditions of levees in the peat areas. As these levees become more stable the level can be increased. Flood levels will not be increased above those of floods in the past, in fact flood conditions will be improved in all but the most severe and protracted floods.

21. The salt water barrier, if built, will affect agriculture and the industries and activities along the bay and lower river as shown in the following statement:

A. AGRICULTURE

(a) A salt water barrier at Point San Pablo will make fresh water available for the irrigation of 51,000 acres of marsh and 48,000 acres of high land around San Pablo Bay. There is no known source of water for this area of land at present. If such lands are increased $50 an acre above cost of irrigation works, the total increase in value will be $4,950,000.

(b) A salt water barrier in Carquinez Strait or at Army Point will make fresh water available for 163,000 acres (marsh 70,000 acres; high lands 93,000 acres) around Suisun Bay. There is no other known source of water for this area. At $50 an acre, the increased value above cost of irrigation works will be $8,150,000.

(c) Either location of barrier will solve the irrigation problem for the lands now irrigated from tide waters in the delta and adjoining it. The area now watered is about 360,000 acres. The total area of irrigable lands is estimated as 458,000 acres. The area menaced by salt water is 169,000 acres. The value of this land is $35,000,000. Improvements at 20 per cent of land value add another $7,000,000.

There will be some increment in value to all the delta area from the security which the salt water barrier will bring about.

(d) The salt water barrier will benefit the areas up-stream from tidal lands by removal of litigation which is now a source of expense and annoyance and which is an obstacle to future projects.

SALT WATER BARRIER

Comparison of Estimated Costs for Alternate Design at Four Sites.

DISTINGUISHING FEATURES OF ASSUMPTIONS OF DESIGN

No	Estimated Cost	Highway and Railway Bridge			Locks		Flood Control Gates			
		Minimum Clearance at Locks	Decks	Piers or Towers	No.	Location	No.	Size	Location	Pier Width
				ARMY POINT-SUISUN POINT AND ARMY POINT-MARTINEZ						
1	$46,300,000		No Bridge		5	In Suisun Point	14	70x80	Partially in Suisun Pt.	20 Ft.
							2	50x80		
2	49,[illegible]	50 Ft.	Single	Concrete	3	In Suisun Point	do	do	Partially in Suisun Pt.	15-20
3	54,[illegible]	50 Ft.	Single	Concrete	3	In Suisun Point	30	50x60	Partially in Suisun Pt.	15 Ft.
4	55,[illegible]	50 Ft.	Single	Concrete	3	Offshore from Suisun Pt.	15	70x80	Partially in Suisun Pt.	20 Ft.
5	58,[illegible]	50 Ft.	Single	Concrete	3	Offshore from Suisun Pt.	30	50x60	Partially in Suisun Pt.	15 Ft.
6	77,[illegible]	50 Ft.	Single	Concrete	3	Offshore from Martinez	15	70x80	Offshore from Martinez	20 Ft.
					BENICIA-PORT COSTA					
7	40,[illegible]		No Bridge		4	In Benicia	30	50x60	Offshore from Benicia	15 Ft.
8	46,[illegible]	50 Ft.	Single	Concrete	4	In Benicia	30	50x60	Offshore from Benicia	15 Ft.
					DILLON POINT-ECKLEY					
9	38,[illegible]		No Bridge		4	In Dillon Point	15	70x80	Offshore from Eckley	50 Ft.
10	44,[illegible]	50 Ft	Double	Concrete	4	In Dillon Point	15	70x80	Offshore from Eckley	50 Ft.
11	44,[illegible]	50 Ft	Double	Steel	4	In Dillon Point	15	70x80	Offshore from Eckley	50 Ft.
12	47,[illegible]	135 Ft	Double	Steel	4	In Dillon Point	15	70x80	Offshore from Eckley	50 Ft.
13	50,[illegible]	50 Ft.	Double	Concrete	4	In Dillon Point	21	70x80	Across Carquinez Sts.	50 Ft.
14	50,[illegible]	50 Ft	Double	Steel	4	In Dillon Point	21	70x80	Across Carquinez Sts.	50 Ft.
15	53,[illegible]	135 Ft	Double	Steel	4	In Dillon Point	21	70x80	Across Carquinez Sts.	50 Ft.
16	97,100,000	50 Ft.	Single	Concrete	4	In Dillon Point	15	70x80	In Dillon Point	20 Ft.
					POINT SAN PEDRO-POINT SAN PABLO					
17	66,000,000		No Bridge		5	In Point San Pablo	15	70x82	Offshore Pt. San Pablo	20 Ft.
18	75,[illegible]00,000	50 Ft.	Single	Concrete	5	In Point San Pablo	15	70x82	Offshore Pt. San Pablo	20 Ft.
19	82,100,000	50 Ft	Single	Concrete	5	In Point San Pablo	15	70x82	In Point San Pablo	20 Ft.

One estimate only is given for the Army Point-Martinez Location—Estimate No. 6.
This site was not drilled—Estimates based largely on assumed foundation conditions except for S. P. Co. test pile data.

NOTE—At all sites except Dillon Point-Eckley, conditions are such that flood gates, locks, piers, etc., would be constructed in the dry behind cofferdams. A limiting depth of 90 feet below mean sea level to rock surface is assumed for this method of construction. The depths at Dillon Point-Eckley exceed this, and Estimates 9 to 15, inclusive, are based upon the placing of concrete under water by the tremie method using caisson gates for the final work on the Stoney Roller Gates. Estimate 16 uses construction methods comparable to those at the other sites as the flood gates are placed in Dillon Point.

(e) The salt water barrier is a step in the direction of carrying out the state's plan of supplying water to the southern San Joaquin Valley —a step in the coordinated plan of water development. It is the first portion of the project which should be built.

B. INDUSTRIES

Industries occupy a large area of land along the waterfront of San Francisco and San Pablo bays, Suisun Bay and Carquinez Strait. Between Oleum and Antioch there are seventeen large industrial plants and a number of smaller ones. On the north side of the straits there are two large industries besides the Mare Island Navy Yard and Benicia Arsenal.

These industries are of the "heavy" type, fundamental industries, which produce essential products necessary both in war and peace. Steel and iron, petroleum products, chemicals, fertilizers, powder and fuse works, leather, brick and tile, flour and feed, roofing lumber and wood products, fish, canned goods and sugar are produced in large quantities. The products of these works have an annual value of $250,000,000. Freight in and out of the district approximates 14,000,000 tons a year. Expenditures for electric power average $800,000 a year. The average number of employees is 8500, having an annual payroll of about $15,000,000. The portion of the population of towns and suburban territory dependent on these industries includes 30,000 inhabitants.

The industries are large users of water. At present ten million gallons a day are used, not including the navy yard or arsenal, and the annual increase in use by the establishments is one million gallons a day.

Immediately adjoining the industrial area above described are other large establishments which could receive benefit from the fresh water reservoir created above the barrier. If the zone along the waterfront to Richmond were included, the annual value of products for the whole territory would be $515,000,000; the number of employees 17,000; the annual payroll $29,000,000. A part of this area is within the East Bay Municipal District.

Since the salt water menace became widely advertised through the Antioch litigation, only one new industry of large size has been established in this terrtiory. The factories already established have continued to grow, but the uncertainty about fresh water has discouraged new industries seeking location. Fresh water in large quantities at low prices is essential to the prosperity of such establishments. Water from any existing utility or municipal district is too high in price for these "heavy" industrial plants.

Ordinarily such works locate where water can be had for the cost of pumping, and such manufacturing establishments will not go to any place where practically free water is not available. There is no other location in California suitable for heavy industries where this condition can be created.

The establishment of new basic industries will be attracted by abundant cheap water. If California does not provide the proper location, Seattle or Portland or some other northern locality will offer greater inducements and many industries will establish Pacific Coast branches in these northern cities. There are in these other states large areas of land where pure fresh water is abundant and may be had for

the cost of pumping from permanent running streams. Further than this, rates for water in the cities are cheaper than in California. Below are given the costs of 500,000 gallons of water in the principal Pacific Coast cities:

Cost of 500,000 Gallons of Water Per Month

San Francisco	$157.56
Oakland	161.71
Los Angeles	72.16
Stockton	54.50
Portland	44.11
Seattle	32.94

One of the greatest needs of the state today is a fresh water reservoir around which factories could be located with assurance of a permanent supply of water. Probably no single accomplishment in the construction program now under discussion would do more toward progress. More factories mean greater population and more local markets for agricultural produce, and the general level of prosperity of the state will be raised.

Salt water is detrimental to the piping and more costly to handle in factories of this sort. The increased annual cost to the users of saline water is estimated to be $300,000 a year through deterioration of equipment and piping in the industries now established. This sum capitalized at 6 per cent means the equivalent of an investment of $5,000,000.

Some of the industries, notably the sugar refinery at Crockett and the chemical works at Pittsburg and Nichol, require water free from saline matter. The presence of salt water in the river for long periods of each year has been the cause of much expense and annoyance in these establishments, and brings seriously to consideration the ability of these factories to continue to exist under the trying conditions.

The salt water barrier will remove the cause of additional expense to the plants now located here, will encourage their more rapid growth, and will offer a great incentive to new establishments to locate here. Large industries require, in addition to large quantities of pure water, cheap power, efficient transportation facilities, preferably both by rail and water, and a good climate attractive to labor. The lower river and upper bay regions lack only water. The salt water barrier will supply this single deficiency. If the barrier is not built, California, without doubt, will lose many important factories.

C. DOMESTIC WATER SUPPLY

The domestic water supply of towns along the straits in Suisun Bay is high in price and limited in quantity. Vallejo, the only exception to this statement, recently has constructed Gordon Valley Reservoir on Suisun Creek, and has a permit to store 10,000 acre-feet and to divert 5000 acre-feet annually. Other towns have no large amount of water for future growth. In fact lack of available water has been a deterrent to the location of industries and the resultant increase in population.

A salt water barrier will solve the water difficulties. If the barrier is located at San Pablo Point, the entire area can be supplied with fresh water; if the barrier is located at Army Point or in Carquinez Strait, all towns on Suisun Bay and in the lower river will be on fresh water; towns below the barrier, such as Crockett, can be readily supplied with short pipelines heading above the barrier.

Either barrier will be of benefit to the city of Sacramento in preventing the upflow of tide and reducing the menace of sewage water being carried toward the water intake.

D. TRAFFIC ACROSS STRAIT

Routes of travel between northern and southern parts of the state naturally pass through Carquinez Strait. The Southern Pacific Company maintains ferries for trains between Benicia and Port Costa and for passengers between Vallejo Junction and Vallejo. The Sacramento-San Francisco Railroad maintains a train ferry from Mallard to Chipps Island. A bridge for vehicular traffic now crosses the strait just below Crockett. A ferry for automobiles and passengers is maintained between Martinez and Benicia.

At Richmond an automobile ferry is in operation a short distance below the site of the proposed salt water barrier at Point San Pablo.

A barrier at San Pablo can be made to serve as a bridge. There are now two applications for bridge permits near this place. The estimated cost of these bridges is from $10,000,000 to $20,000,000. The difference between the cost of a barrier with and without bridge is estimated by Young to be $9,000,000.

At Army Point a bridge 50 feet above water increases the cost $3,500,000; at Benicia a bridge 50 feet above water level increases the cost $6,000,000; at Dillon Point a bridge with a clearance of 50 feet increases the cost $3,800,000; a bridge with clearance of 135 feet increases the cost $8,700,000. Approximate figures indicate that a railroad bridge near the location of the present Southern Pacific ferry between Benicia and Port Costa will cost in excess of $10,000,000. Upon this estimate railroad transportation could bear a part of the cost of barrier. Vehicular traffic is growing so rapidly that there will be need for a second bridge across the straits within a few years.

E. POWER COMPANIES

The power companies are interested in the salt water problem because it has decreased their market for power by discouraging new plants from locating here and by reducing the growth of those already established.

The litigation over water rights may seriously affect their plants supplied from storage in the mountains.

F. FISHING INDUSTRY

Fishing in the bay and rivers is important. Salmon, shad and striped bass are important commercial fish. Smelt and smaller fish are important in furnishing food for commercial varieties. Sturgeon are nearly extinct, but it is the endeavor of the Fish and Game Commission to prevent complete extinction and to encourage increases in this species.

The salt water barrier will be an obstacle to migrating fish during low water season. Young's plans provide for fishways and it is his belief that fish will use the locks and that on the whole the barrier will not obstruct the migration. Objection to any forms of barrier will be raised by the fishing industry. Wherever the structure is built there will naturally be some obstruction to free migration of the fish. It is probable, however, that the structure can be so designed and operated as to do only a small amount of damage.

G. NAVIGATION

Any barrier is an obstacle to free movement of vessels, and it is to be expected that owners of vessels will object to the project. This objection arises from the delays caused by using locks and the danger of handling vessels in such restricted quarters, particularly in foggy periods.

As to delays, it may be said that ordinarily the time lost in transit through locks will be regained by the freedom from adverse currents above the locks. While this will depend upon the place to which the vessel is bound, it is believed that for the great bulk of traffic the delay is likely to be small.

The danger to vessels maneuvering in approach to locks is of course real, but with the safeguards now provided for vessels the risk is small and there are compensating advantages. The ability to dock without tidal currents, as would be true above the barrier, is both a saving in time and reduction of risk. The cleansing action of fresh water upon the bottoms of ocean-going vessels is valuable.

The fear that the barrier will cause silting in channels or create changes in the Golden Gate bar does not seem to be well founded. Sediment moves almost entirely at flood times when the barrier will be open and the current constantly down-stream. The movement of sediment will probably be facilitated rather than retarded.

Owners of shipping facilities are of course interested in the growth and prosperity of the communities served. The industrial area which will grow up around the fresh water reservoir above the barrier will produce freight for vessels at a greatly increased rate. The depth of water through Suisun Bay and to Stockton will be increased to 26 feet under the plan already adopted by congress. The depth of channel will be ample for from 73 to 88 per cent of the vessels normally entering the Golden Gate during a year.

In considering the location of the barrier, the extent of shipping is important. The farther downstream the greater the traffic through locks, the greater quantity of water required for lock operation, and the greater will be the objection by the shipping interests. In this regard the upper location of the barrier will meet with the least objection.

The Navy Yard is above San Pablo site and naval officers will probably be impressed with the difficulties presented by the barrier in time of war. Here we have another and important reason for the selection of the upper site.

H. STRUCTURE BUILT IN WATER

Teredos and other wood-destroying animals have caused damage to structures in San Francisco Bay waters in excess of $25,000,000 since 1914, according to estimates made by the San Francisco May Marine Piling Committee. In the upper bay region teredos have gone as far as Antioch. All structures built in water which may become brackish must be constructed of treated piles or of concrete. Brackish water carried up by tides will continue to cause greater expense in all structures built in water and greater maintenance costs. It is difficult to measure this damage in dollars, but it is a very considerable sum annually.

A salt water barrier will reduce the maintenance cost of structures and will make it practical to build structures as economically as was done prior to the invasion of salt water.

SOLUTION OF THE SALT WATER PROBLEM

23. The salt water problem may be partially solved in several ways, but completely only in one way. Conditions may be ameliorated by storage and release of water from reservoirs to push back the salt water or water supply from outside sources may be brought in to supply fresh water through conduits or pipes.

The only satisfactory solution of the problem is the salt water barrier. These methods are briefly discussed below:

STORAGE AND RELEASE TO PUSH BACK SALT WATER

24. This method of solving the salt water problem has been suggested in several recent publications of the Department of Public Works. Examination in detail of the proposals shows that "salt water control" means the supplying of water of less than 100 parts chlorine per 100,000 to the delta lands.

Emmaton on the Sacramento River and Jersey Island on the San Joaquin are the limits of control and no suggestion has been made that it is practical to release water to supply Antioch or any of the lower industrial area. This, in fact, leaves out of consideration the area now most seriously damaged.

Studies by the Division of Water Rights based on records including the year 1925 show that to control salinity below 100 parts chlorine per 100,000, the combined flow of Sacramento River at Sacramento and the San Joaquin at Vernalis (both points about head of tide water in late summer) must exceed the following figures:

For control at	*Cubic feet per second*
Emmaton and Jersey Island	3500
Antioch	5000
Collinsville	5500
O. & A. Ferry	6000

These quantities will depend to some extent upon the months preceding the period when control is desired, and will, of course, vary with the diversions below the points of measurements. Furthermore, storage of water above tide level will affect the matter by limiting the distance salt water is forced downstream by spring floods.

To effectively supply these quantities of water will require very large storage capacity in dry years.

In 1924 storage in excess of a million acre-feet would have been required to control salinity at the O. & A. Ferry and 200,000 acre-feet at Emmaton and Jersey.

Storage in large amount would be needed about half the years at Emmaton and Jersey, and every year for control at the O. & A. Ferry.

The above is under the assumption that storage and diversions in these two valleys does not increase. As shown earlier, this condition has already been violated, for there has never been such increased activity in building storage reservoirs as in the period since 1924. Many reservoirs are planned for construction in the near future. Furthermore, diversions increase every year.

Estimates of the quantities required for storage control must therefore be continuously revised upwards.

Release of stored water, to control salinity, will occur in dry parts of the year and to greatest extent in dry years. To effectively control the right of storage and release, all riparian owners below the reservoir must agree to the arrangement. As the law now stands, the use of such a reservoir may be enjoined and it will be impossible to prevent—except through litigation—the riparian owners from diverting the released water. The difficulty can be removed by condemnation of rights along the stream. The problem looks too large for human accomplishment in any reasonable time and at reasonable cost.

To one acquainted with water problems in California, it does not seem reasonable to expect that in the dry part of a dry year a flow of 5000 or more feet per second would be allowed to pass pumps and ditches, under which crops were suffering, in order that salt water could be pushed back into the ocean. As to the cost of storage reservoirs to accomplish the release for salt control, there is little definite information which permits a comparison of costs. The following statements are of interest:

Kennett Reservoir is proposed by the State Department of Public Works as a unit in the "Coordinated Plan." (See Bulletin 13 of the Department of Public Works, 1928.) The recommended reservoir capacity is 2,940,000 acre-feet; the estimated cost of dam and rights of way is $55,000,000; of power plant $25,000,000; a total of $80,000,000. With allowances for prior rights, the mean annual irrigation yield of reservoir will be 2,838,000 acre-feet. In minimum years the deficiency would be large; 19 per cent in 1920; 42 per cent in 1924. If this reservoir were depended upon for salinity control, the entire available supply would be needed to control salt water at the mouth of the river, leaving no water for the area depending on this reservoir for irrigation. In other words, the very year when the reservoir is most needed it would be of little practical use. Furthermore, Kennett is not practicable unless operated to generate electric power. If the water is held and released for salt water control, the power value is greatly decreased.

Iron Canyon Reservoir is proposed as a secondary unit in the "Coordinated Plan." (See Bul. 13, Dept. of Public Works.) The recommended capacity is 1,121,900 acre-feet; the cost of dam and power plant is estimated as $26,000,000; the canal system to utilize this water is estimated at $30,000. The reservoir may be utilized in controlling salinity. To quote from the above mentioned report, page 115:

"Sacrificing the power feature at Iron Canyon dam would, with other construction unchanged with the exception of the arrangement of outlets through the dam, supply a reserve storage of 364,600 acre-feet of water in Iron Canyon reservoir to overcome, or alleviate, the salt water menace in the delta region should such be desirable. Such use is not advocated, but it is demonstrated that there are possibilities along this line."

Should the irrigation feature likewise be disregarded, Iron Canyon would provide a net annual irrigation draft of 800,000 acre-feet or just about enough water to control salt water as low as the mouth of the river—provided the water could be carried past head gates and pumps on its way to tidal waters. Under this condition the power feature

would be sacrificed to a larger extent. It is difficult to picture a dry year when water and power are both scarce, in which it would be possible to release a large quantity of water, disregarding its best use for power, and have the riparian and appropriative users of water along the hundred and fifty miles of the Sacramento River permit this flow to pass by uninterrupted to tide water. The plan does not look practical.

Other reservoirs may be used for the same purpose, that of increasing the flow to control salt water. For example, a reservoir on Feather River has been suggested, and another on the American at Folsom. Both of these reservoirs will have value for power development and that value will be greatly reduced if a large quantity of water is held for saline control. The most practical suggestion is in connection with a reservoir on Dry Creek, north of the Mokelumne, the water to be diverted from the Mokelumne River. The rights obtained by the East Bay Municipal Utility District for storage in Lancha Plana Reservoir practically eliminate this reservoir from consideration. In connection with the proposal for storage and release of water, it should be remembered that the State Department of Engineering has made the suggestion as a temporary expedient, with the expectation that permanent relief would be brought about by the construction of the salt water barrier. This state of affairs would leave the delta lands dependent on a temporary right to be replaced by a permanent right which would be arranged for at some later time. With the growing condition of California and the certainty that the temporary supply will be invaded by increased diversions, this is a very precarious water right, not one which will satisfy the delta land owners. Furthermore, the plan does not consider users below the delta, either towns or industries.

New industries will not be attracted by any temporary improvement in water conditions. Some permanent solution must be reached. It is important to California to have the decision made at once so that the great industrial expansion now going on can be located to a maximum extent in this state.

WATER FROM OUTSIDE SOURCES

25. Under present conditions the towns and industrial area can not look to any place within tide water level for a source of water. Above tide levels the following are the principal supplies which may be considered:

Eel River,
Conn Valley,
Putah Creek,
Mokelumne or Cosumnes,
Pumped water from irrigation districts, San Joaquin Valley,
East Bay Municipal Utility District.

All of these sources may be considered, but as all are distant, with long pipe lines and other costly works, they will be able to supply water only at relatively high cost, prohibitory to the types of factories now located in Contra Costa and Solano counties. Piping water across these straits will be a very costly and difficult affair. The barrier removes the necessity of any pipe line crossing.

LOCATION OF BARRIER

26. For the purpose of providing fresh water to cities, industries and agriculture on adjoining land, the lowest location of the barrier accomplishes the most. However, water supply, cost and convenience to other interests must be considered before the location can be selected. The following may be said on these points:

Water Supply. The attached tables give the requirements for fresh water above the barrier upon the assumption that development is complete. These figures, in part, are taken from the Young report—in part are the results of studies made for this investigation.

Requirements for the full year are:

Army Point	1,160,000 acre-feet
Point San Pablo	2,024,000 acre-feet
Difference	864,000 acre-feet

For the irrigation period May to September, inclusive, the requirements are:

Army Point	638,000 acre-feet
Point San Pablo	1,236,000 acre-feet

Additional storage on the headwaters will be required to supply the barrier at San Pablo.

Cost. Young's estimate of cost of barrier with bridge of clearance of 50 feet is as follows:

Point San Pablo	$75,200,000
Army Point	49,800,000
Difference	$25,400,000

Convenience of Other Interests. San Pablo site is below the Mare Island Navy Yard, a great obstacle. Navy men will be against the project. Shipping interests will be more inconvenienced with the lower site occupied. At present about two-thirds of the vessels that pass Point San Pablo continue upstream above Army Point. The San Pablo site will be a convenience to vehicular traffic. The Army Point site will be convenient for both vehicular and railroad traffic, though at present vehicular traffic is cared for by the Carquinez Bridge.

FINAL CONCLUSION

27. If the salt water barrier is built at Army Point to carry vehicles and railroads, and the proper part of the cost paid by these interests, the salt water problem can be solved permanently and cheaper than by any other solution that has been suggested.

The cost of a bridge for rail and automobile traffic at Army Point can not be determined without more work than is possible in an investigation such as this. It can be safely said, however, that the cost will exceed $10,000,000. Automobile traffic over the Carquinez Bridge (which has been in use less than a year) is at the rate of approximately 1,100,000 automobiles a year and is growing rapidly. There will be economic justification for an auto bridge at Benicia before it can be built. Automobile traffic will justify an expenditure of over $10,000,000. The two combined will be over $20,000,000. If this figure is taken as the value to transportation, there will be left, approximately, an equal sum to be paid by other benefits.

Iron Canyon Reservoir, the only definite storage reservoir suggested for temporary control, will cost $26,000,000. The salt water barrier would permanently solve the difficulties for a smaller sum.

TABLE 1

Average Miles Traveled by Water Barge California-Hawaiian Sugar Company

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1908	19.8	11.6	12.5	14.0	12.9	16.7	26.3	26.8	33.2	27.1	24.8	25.7
1909	6.9	0	4.5	7.7	5.0	4.7	10.5	19.4	23.2	24.2	21.0	11.7
1910	9.6	10.0	3.8	3.0	6.4	10.8	20.4	26.7	27.6	25.4	24.6	19.7
1911	11.6	2.3	16.2	1.0	2.1	0.7	5.7	16.4	23.2	24.5	24.7	25.5
1912	22.0	16.1	14.5	12.7	8.8	7.1	17.6	24.7	24.4	24.2	19.0	18.5
1913	16.4	13.6	13.2	9.9	6.9	10.3	21.0	25.7	26.6	27.8	26.1	20.4
1914	2.1	1.2	1.6	2.5	2.2	3.4	10.3	20.0	24.4	24.5	23.9	23.7
1915	16.4	2.3	3.1	4.3	2.6	3.7	12.6	20.8	24.4	24.2	23.0	17.5
1916	4.9	0.5	1.0	2.3	6.4	5.8	13.2	22.6	25.0	21.7	21.2	15.4
1917	16.0	13.1	6.5	6.3	3.5	4.8	15.5	24.9	26.2	26.0	25.1	24.4
1918	24.3	15.1	9.6	6.2	9.2	15.0	27.0	38.5	37.2	23.0	23.1	21.0
1919	20.4	9.4	7.7	5.7	4.3	14.1	35.3	37.7	37.7	26.8	25.7	25.5
1920	23.8	24.0	17.2	12.0	12.9	17.4	26.0					

TABLE 3

Commercial Fishing—San Pablo and Suisun Bays and Sacramento and San Joaquin Rivers

(Varieties)

Year	Salmon Native	Shad Planted	Striped Bass Planted	Total Pounds
1919	4,529,048	1,573,713	759,733	6,862,494
1920	3,860,312	1,409,322	668,290	5,937,924
1921	2,511,127	797,128	599,698	3,907,953
1922	1,765,066	1,109,445	682,717	3,557,228
1923	2,243,945	1,285,334	906,869	4,436,148
1924	2,640,110	1,538,735	658,244	4,837,089
1925	2,778,846	2,439,441	836,301	6,054,588
1926	1,261,776	902,202	749,573	2,913,551
1927	920,471	4,103,012	644,789	5,668,272
Total, 9 Years	22,510,701	15,158,332	6,506,214	44,175,247
Mean	2,501,189	1,684,259	722,913	4,908,361

The run of fish will vary from year to year in accordance with weather, feed and unknown factors.

A low or high run for one year may not mean absolute evidence of either increase or decrease in the species.

For example, the extremely low run of salmon in 1927 does not necessarily mean still lower run in 1928, and similarly with shad in reverse tendency.

However, there seems to be a general decrease in salmon, probably an increase in shad, and a static condition in striped bass.

TABLE 2

Combined Flow of Sacramento and San Joaquin Tributaries

(Flow in Second-Feet)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1916	66,670	92,200	99,830	88,621	73,060	55,619	23,900	11,112	9,300	12,261	11,522	19,986
1917	16,712	56,000	34,521	71,153	69,307	63,407	20,082	9,787	8,309	7,875	8,639	11,071
1918	9,180	21,849	50,360	51,091	39,145	32,183	9,563	6,885	8,621	13,041	11,956	12,118
1919	19,653	58,664	44,948	63,700	65,666	18,261	8,975	7,275	7,049	7,732	7,172	11,469
1920	9,075	9,560	26,759	41,822	49,582	27,404	9,931	6,722	6,059	8,557	39,737	48,539
1921	73,000	58,400	69,470	55,291	65,385	50,246	15,606	8,297	7,435	7,589	8,389	19,407
1922	17,560	50,030	41,389	61,190	109,494	82,327	20,879	9,022	7,329	8,334	11,828	35,715
1923	29,742	22,089	23,785	55,290	54,199	31,844	17,138	9,798	8,809	10,004	7,810	7,919
1924	8,617	19,248	10,222	15,623	14,458	7,007	5,981	5,601	5,171	7,056	13,214	15,029
1925	15,018	89,005	34,394	63,127	59,990	32,824	13,486	9,030	8,535	8,626	9,361	11,720
1926	13,056	57,377	26,823	60,494	30,503	13,603	9,732	8,522	7,364	7,730	32,243	31,338
1927	35,293	109,044	54,556	75,100	59,973	45,353	16,984	11,349	10,652			

No allowance for power storage or regulation.

Combination of

Sacramento at Red Bluff,
Feather at Ornville,
Yuba at Smartsville,
Bear at Van Trent,
American at Fair Oaks,

and

Mokelumne at Clements,
Stanislaus at Knights Ferry,
Tuolumne at La Grange,
Merced at Exchequer,
San Joaquin at Friant.

TABLE 4

Population of Bay Counties—U. S. Census

	1920	1910	1900	1890	1880	1870	1860	1850
State	3,426,861	2,377,459	1,485,053	1,213,398	864,694	560,247	379,994	92,597
Alameda	344,171	246,131	130,197	93,864	62,976	24,237	8,927	
Contra Costa	53,889	31,674	18,046	13,515	12,525	8,461	5,328	
Marin	27,342	25,114	15,702	13,072	11,324	6,903	3,384	323
Napa	20,678	19,800	16,451	16,411	13,235	7,163	5,521	405
Sacramento	91,029	67,806	45,915	40,339	34,390	26,880	24,142	9,087
San Francisco	506,676	416,912	342,782	298,997	233,959	149,473	56,802	
San Joaquin	79,905	50,731	35,452	28,629	24,349	21,050	9,435	3,647
San Mateo	36,781	26,585	12,094	10,087	8,669	6,635	3,214	
Solano	40,602	27,659	24,143	20,946	18,475	16,871	7,169	

TABLE 5

School Enrollment Bay Shore Districts—Contra Costa County

	1915	1921	1927
Elementary Schools:			
Oakley	85	118	158
Antioch	333	454	731
Pittsburg	668	1,122	1,485
Bay Point	85	----	162
Martinez	403	792	1,068
Port Costa	122	108	75
Carquinez (Crockett)	447	572	617
Selby	72	99	128
Rodeo	108	132	198
Pinole Hercules	227	258	217
San Pablo	182	227	282
Richmond	2,288	3,380	3,997
Total Elementary	5,020	7,262	9,118
High Schools:			
Antioch	105	142	149
Pittsburg			183
Alhambra, Martinez	77	121	294
John Swett, Crockett	86	119	206
Richmond	242	655	754
Total High School	510	1,037	1,586
Total both	5,530	8,299	10,704

TABLE 6

Water-Borne Traffic, U. S. Engineering Department Data

(Total movement, tonnage and values in thousands of tons and thousands of dollars)

Year	Suisun Bay		Carquinez Strait		San Pablo Bay		Grand Total	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value
1917	No Data		Incl. in San Pablo		11,946	$212,592		
1918	No Data		Incl. in San Pablo		4,330	152,206		
1919	305	$7,034	Incl. in San Pablo		4,634	184,476	4,939	$191,510
1920	433	13,877	2,079	$97,991	1,696	54,620	4,208	166,488
1921	562	19,670	1,720		2,019	96,177	4,301	
1922	1,329	32,006	No Data		2,652	118,234		
1923	2,659	43,764	No Data		2,466	109,022		
1924	2,341	51,066	No Data		4,200	156,999		
1925	4,204	88,670	7,673	183,000	4,754	234,409	16,631	506,079
1926	4,205	90,687	7,844	135,522	4,667	260,920	16,716	487,129

Totals are only shown where data are complete for all divisions.

In addition to above, in 1926, there was a total of 1,752,000 tons valued at $124,077,616 to or from the Sacramento and San Joaquin rivers, most of which passed through Carquinez Strait. However, all of this having origin and destination in the above Bay division, it appears there also.

Railroad ferry freight traffic across Carquinez Strait was, in 1925, 2,706,000 tons; in 1926, 2,650,000 tons.

TABLE No. 7

Ocean-Going Water-Borne Traffic, U. S. Engineering Department Data

(Tonnage in thousands of tons and values in thousands of dollars)

Year	Suisun Bay		Carquinez Strait		San Pablo Bay		Grand total	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value
1925	2,659	$43,823	5,188	$147,485	4,011	$66,999	11,858	$258,307
1926	2,495	41,173	4,264	107,228	3,866	58,942	10,625	207,343

Data do not permit a separation of bay business from ocean-going business previous to 1925, and Carquinez Straits data are entirely lacking for the years.

The magnitude of the petroleum products traffic and the proportion of the total it occupies are obvious when the following tables are compared with the above.

Year	Suisun Bay		Carquinez Strait		San Pablo Bay		Grand total	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value
1925	2,464	$34,391	4,415	$49,562	3,837	$45,715	10,716	$129,667
1926	2,168	33,663	3,409	40,454	3,708	43,837	9,285	117,954
OUTGOING BAY AND OCEAN WATER-BORNE PETROLEUM PRODUCTS								
1925	547	$20,811	2,949	$38,217	1,019	$19,783	4,515	$78,811
1926	615	29,989	2,746	35,197	940	23,837	4,301	89,023

Does not include Standard Oil Co. Richmond plants.

TABLE No. 8

Sacramento and San Joaquin River Traffic, U. S. Engineering Department Data

(Tonnage and values)

Year	Sacramento River Tons	Sacramento River Value	San Joaquin River Tons	San Joaquin River Value
1910	496,147	$29,522,151	631,681	$32,878,108
1911	505,285	32,139,048	600,128	35,768,215
1912	477,292	27,755,325	632,591	38,854,539
1913	733,594	35,856,791	820,399	38,341,174
1914	721,090	38,211,760	772,156	35,479,741
1915	766,935	38,027,703	831,234	36,358,240
1916	875,780	46,908,093	824,222	42,179,160
1917	947,690	96,820,992	1,890,856	50,367,760
1918	1,053,510	113,991,123	2,114,382	65,204,825
1919	1,666,025	78,601,238	647,156	54,100,043
1920	1,377,700	53,946,146	692,306	42,203,211
1921	976,596	52,092,263	646,657	37,263,122
1922	1,291,135	60,606,728	678,751	34,291,675
1923	1,264,821	62,470,235	697,773	38,027,909
1924	1,796,104	58,662,997	727,499	38,185,313
1925	1,427,230	80,500,145	849,687	47,192,499
1926	1,222,993	85,315,284	934,809	56,455,662

Contains also movements between river points only.

TABLE No. 9

Water Requirements for Operation of Salt Water Barrier When Fully Developed

(Quantities in second-feet)

POINT SAN PABLO

	1	2	3	4	5	6	7	8	9	10	11	12
Fish ladder	35	35	35	35	35	35	35	35	35	35	35	35
Industries, etc.	322	322	322	322	322	322	322	322	322	322	322	322
Gate leakage	166	166	166	166	166	166	166	166	166	166	166	166
Oper. locks	705	705	705	705	705	705	705	705	705	705	705	705
Evaporation	250	300	450	650	950	1,200	1,250	1,170	1,020	800	500	200
Irrigation	---	---	---	---	610	1,680	2,290	1,910	1,150	---	---	---
Flushing	200	200	200	200	200	200	200	200	200	200	200	200
Totals S. F.	1,678	1,728	1,878	2,078	2,988	4,308	4,968	4,508	3,598	2,228	1,928	1,628

TABLE No. 10

Water Requirements for Operations of Salt Water Barrier When Fully Developed

(Quantities in second-feet)

ARMY POINT

	1	2	3	4	5	6	7	8	9	10	11	12
Fish ladder	35	35	35	35	35	35	35	35	35	35	35	35
Industries, etc.	155	155	155	155	155	155	155	155	155	155	155	155
Gate leakage	166	166	166	166	166	166	166	166	166	166	166	166
Oper. locks	246	246	246	246	246	246	246	246	246	246	246	246
Evaporation	110	146	200	288	422	530	555	522	455	355	222	89
Irrigation	---	---	---	---	380	1,050	1,430	1,190	710	---	---	---
Flushing	200	200	200	200	200	200	200	200	200	200	200	200
Totals, S. F.	912	948	1,002	1,090	1,604	2,382	2,787	2,514	1,967	1,157	1,024	891

TABLE 11

Water Requirements Above Salt Water Barrier When Fully Developed

(Quantities in acre-feet)

	Army point	Point San Pablo
January	56,000	102,500
February	52,500	95,500
March	62,000	115,000
April	65,000	123,000
May	98,500	184,000
June	147,500	256,000
July	171,000	305,000
August	154,000	277,000
September	117,000	214,000
October	71,000	137,000
November	61,000	115,000
December	54,500	100,000
Totals	1,110,000	2,024,000

EXHIBIT "D"

MEMORANDUM
To
THE JOINT LEGISLATIVE COMMITTEE
TO INVESTIGATE THE
WATER RESOURCES OF CALIFORNIA

By
A. M. BARTON
Chief Engineer and General Manager
State Reclamation Board
of California

State Office Building
Sacramento, California

November 30, 1928.

Joint Legislative Committee to Investigate
the Water Resources of California.
Mr. B. S. Crittenden, Chairman,
139 North A Street,
Tracy, California.

DEAR SIR:

On November 20th the writer appeared before your honorable committee in behalf of the American River Flood Control District and, after dwelling briefly on some of the phases of the American River situation, was granted the privilege of presenting a more complete and detailed statement in written form.

It is now manifest that to serve the most broadly beneficial public interests, the scope of the American River development must be extended to that of a major project. As such, it must necessarily have an important bearing upon interests other than those pertaining to the controlling of floods. It is therefore proposed to discuss also certain other relevant features which appear to warrant the serious consideration of your committee.

In order, however, that our primary purpose may not be obscured, it is desired at the outset to define the issue with which we are principally concerned and to direct your attention to the magnitude of the stakes involved therein. The area within the boundaries of the American River Flood Control District, some 22,500 acres, includes the cities of Sacramento and North Sacramento. The population of this area is estimated at 104,000 and the assessed property valuation is approximately $105,000,000. No later than last spring the American River again vented its fury on this region and about 13,000 acres were flooded to depths up to twelve feet. The levees of Sacramento held, but the unprotected city north of the American suffered heavy losses of property and at least one death was directly attributable to the flood. Railroads and highways were submerged and for a period of days there was no traffic over the roads leading north and east from Sacramento.

This is by no means the first time these conditions have obtained and there is no assurance whatever that within the next three months a thousand families may be forced from their homes. The State of California has aided in the reclamation of about one million acres of agricultural land. When one considers this fact, it seems incredible that the just demands of a rapidly growing community immediately adjacent to the capital shall go unheeded.

For the past four years the development of the American River at Folsom has claimed the attention of those interested in conservancy measures and in particular, those concerned with flood control by storage regulation. At the last Legislature an act was passed specifically defining the obligations of any private interests to be traded with by the state in return for control of certain of its properties at the Folsom penitentiary. This act in effect burdens the promoters with the expense incidental to the installation and operation of flood control features which must necessarily be incorporated in the dam in order to accomplish the desirable purposes. It also comprehends the solution of the salinity problem of the delta region.

Since this act was drawn, radical changes have occured in the situation both as to flood abatement and salinity control and an urgency heretofore not sensed has become apparent. The flood of March, 1928, has most forcibly brought home to the people a full realization of the menace which exists in the uncontrolled flow of the American River and vigorous action is now being had by the American River Flood Control District in an endeavor to solve the flood control problem. To those who have studied the situation it is obvious that the most economical solution involves regulation of flood flows by storage. It is further obvious that the provision of such regulation can not long be deferred. The rapidly growing community north of the American River is wholly at the mercy of the vagaries of that stream. The loss of life, destruction of property and adverse publicity suffered by the capital of this state in the recent flood is freshly in the minds of those most vitally interested. Development is being retarded. To defer action is to invite a disaster, recovery from which may not be accomplished in generations.

Those who have suffered from the incursion of salt water in the delta region have entertained great hope for the early construction of a salt water barrier. The plan has been fully investigated by state and federal engineering forces. These investigations reveal that the probable cost would vary from $45,000,000 to $90,000,000 according to the site selected. It was hoped that a considerable proportion of this cost would be borne by transportation interests in return for use of the proposed structure as a bridge across the straits. This hope has been dispelled by an announcement of the Southern Pacific Company which settles the issue by proceeding with the immediate construction of a bridge near the Carquinez ferry. Thus it appears that immediate amelioration of the salt water nuisance can be had only by the releasing of impounded waters.

A practical acceptance of this condition is now evinced by the attitude of the delta interests. These interests now propose the formation of a delta conservancy district, the major purpose of which will be to provide a means for sharing in the cost of storage works proposed under the coordinated plan or any other works capable of remedying the situation. This has all the appearance of a broad-minded proposal. It should, to our notion, receive the sympathetic support of all state agencies and be hastened to an early consummation.

The dilemma with which that region is confronted has been forced upon it by a natural and orderly agricultural development of the Sacramento and San Joaquin valleys. The holders of up-stream agricultural lands have taken water as they pleased and now insist that the delta, although admittedly injured, must solve its own problem and meet the costs incidental to such solution. Tremendous stakes are involved in the delta controversy, involving an area of approximately 600,000 acres from which is derived an annual crop production of between $50,000,000 and $70,000,000. The most valuable agricultural land of the state is in this region and permanent damages due to the infiltration of salt water have already attained vast proportions.

By standing on their riparian rights and vigorously pressing the suits now filed, the delta interests can jeopardize every appropriator in the two valleys. The outcome of such litigation is, of course, uncertain but it cannot fail to result in at least a temporary paralysis of development and great expense.

Fortunately, the inclination of the delta is toward constructive measures. This is indicated by the spirit of the proposed district and the apparent willingness of the land to contribute toward a storage or conservancy project.

It is noted that the delta interests have looked toward the proposed Kennett and Iron Canyon reservoirs as a possible solution of their problems. Our purpose is to bring most emphatically to the attention of all parties the fact that the construction of either of these reservoirs would in no measure provide control of flood waters where such control is most necessary and urgent, the American River area.

It is, of course, true that the construction of either of these units of the coordinated conservancy plan will go far toward solving the salinity problem and, at the same time, be beneficial to the irrigation, navigation and flood control interests of the upper valley. But public policy demands that any development of natural resources shall be so planned as to confer the greatest benefits to the greatest number of beneficiaries and, further, shall be timed so far as is humanly possible, to meet their urgent requirements.

During a normal summer the salinity problem is not acute; the greatest necessity for augmented flow occurs during seasons of subnormal precipitation and this necessity coincides with the maximum requirement for irrigation water. Appropriations from the Sacramento River now amount to nearly double the low flow of the stream. As the development of the upper valley progresses, these appropriations must be increased and it becomes apparent that during a critical season such as 1924, draft from the river would seriously diminish the amount of water dedicated to salinity control. In such case state regulation would become necessary and restriction of diversions could be accomplished only by a close policing of the entire stream. The first concern of the proposed delta district is to secure unimpaired delivery of water, the storage cost of which is partially borne by it.

Flood flow regulation by these upper reservoirs is desirable but will not become absolutely essential until development of the upper valley region has progressed to such a point that the present defenses are inadequate and unless the present rate of development is greatly accelerated, this lies many years in the future.

Irrigation has progressed rapidly in the upper Sacramento Valley. Prior to 1911, diversions from the river were insignificant but with the stimulus of war time prices, great strides were made in the use of water. In nearly every case appropriations were made far in excess of immediate requirements and many years must elapse before development is so intensive as to require that all the water appropriated be actually put to beneficial use. It seems proper that conservation and regulation of the use of the present stream flow should be practiced before a great expenditure is made primarily for an added supply. We are inclined to the opinion that the irrigation interests may best be served by a consolidation of their present position rather than by any great immediate expansion. If an expansion of irrigated land is desirable it seems reasonable that areas without any supply should be provided for first.

The major American River project.

During the past summer further investigation on the American River has indicated that the Auburn Reservoir may be developed in

conjunction with the Folsom Reservoir. The combined capacities of these storage units is 953,000 acre-feet. The Coloma Reservoir which at the date of this memorandum is being further studied, has a capacity of 750,000 acre-feet. There is reason to believe that a satisfactory dam site will be found and if this proves to be the case, the combined storage capacity of the development will be 1,700,000 acre-feet.

Operated as flood control works the Folsom and Auburn units are capable of safely reducing flow down the American River to a maximum of 80,000 second-feet. The inclusion of Coloma Reservoir in the plan will effect a further reduction to a maximum of 60,000 second-feet without interference with the power output.

A method of water release from Folsom and Auburn reservoirs can be devised whereby salinity can be controlled to Emmaton and Jersey in all years, including the critical season of 1924, with but a slight reduction in power yield. The addition of Coloma Reservoir will provide control fully in line with any sane requirement of the delta interests.

The outstanding advantage to be gained through the adoption of the American River development as the first unit of the coordinated plan rather than one on the upper Sacramento River is that of early consummation. We have endeavored to indicate the urgency of the situation both as regards flood control and abatement of the salinity menace. Development at Kennett or Iron Canyon will in no manner alleviate the deplorable situation which exists along the American River and only by a stretching of the imagination can one visualize aid to the delta within the next generation from these sources.

It seems obvious that either of the great developments of the upper Sacramento must be carried forward as state-owned projects. The writer presents no brief for or against public ownership and wishes to avoid any participation in injecting this highly controversial subject into the problem before us. However: the situation appears to demand recognition of the fact that publicly owned entities have not the faculty of moving rapidly. The uncertainties surrounding the upper Sacramento projects—legislative, legal and financial—are such that only a confirmed optimist would hope for the beginning of construction within the next decade. And ten years more might well be required to bring the project to completion.

It has been suggested that early construction of the American River project might retard the upper Sacramento project by saturation of the power market. Our contention, based upon a close study of available statistics, is that the output from the American will long since have been absorbed before the Sacramento power comes on the market.

The primary purposes of Kennett reservoir in the coordinated plan is to make up the deficiency which exists in the water supply of the San Joaquin Valley. Power production is but a means to that end. Flood control and the abatement of the salinity menace are benefits of secondary importance. Salinity control and irrigation of the San Joaquin Valley are contradictory in effect; the one requires that impounded water be passed down the river channel to the sea, while the other presupposes diversion. *Why, then, is it not logical to provide on the American a development which shall be specifically dedicated to salinity control and allow the Kennett project to fulfill the purpose for which it was originally conceived?*

The matter of immediate absorption of the power output from the American project is to our belief wholly within the power of the state administration. We have been advised as to the attitude of the Pacific Gas and Electric Company in the matter of state conservancy measures. We are informed as to the increment of demand upon its system and can visualize no physical obstacle relating to absorption at a satisfactory rate. Armed with this knowledge, the task of the administration in this matter does not appear difficult; it is our belief that it can not only guarantee absorption at a satisfactory rate, but can so influence the rate at which power is to be purchased as to greatly decrease the suggested contribution to the construction fund and at the same time insure a proper and legitimate profit to the promoters and their financial backers.

Briefly stated, the power consumers of the state will share in paying for the benefits to be conferred through flood regulation and salinity control, but it is not to be inferred that their cost will in any measure be increased. Predicated upon the data now at hand, the production costs from this project will be approximately the same as from Kennett or Iron Canyon and being much nearer to load centers, no great transmission costs or losses are involved. No power development project occupies a more advantageous position with relation to the points of use.

The desirable purposes sought by the several interests can be accomplished by a concentration of development on the American River for the next few years, and, being without cost to the parties benefited, its most violent opponent can not demonstrate the plan to be untimely or not in accordance with sound economic doctrines.

Advantages to American River Flood Control District.

The outstanding advantages to be gained by the American River Flood Control District through the regulation of flood discharges by the American project are those which bear directly upon the cost of reclamation. They may be summarized as follows:

Decreased size of flood channel.—Without regulation the required flood channel will be 2400 feet wide; it is economically impossible to continue such a channel to the easterly boundary of the district and some 3000 acres of excellent river bottom land would be denied protection under such a plan. The construction of Folsom Reservoir *alone* will permit the reduction of flood channel width to 1000 feet and the levees can be extended to protect all land in the district.

Under the recently approved federal legislation (Curry bill), it would appear that the State of California would be obligated to acquire such lands as are necessary within by-passes for projects yet to be constructed, of which the American River Flood Control District is a part. The rights to be acquired have been tentatively appraised at an average of $200 per acre and may be considerably greater. The 2400-foot flood channel contains approximately 1200 acres and the 1000-foot channel about 650 acres. It is therefore obvious that the saving to the state through the adoption of the narrower channel will be at least $110,000.

Decreased channel maintenance.—The permanent saving through maintenance of a smaller channel which will devolve upon the state will be considerable, both as to the removal of obstructions to flow in the overflow portion and the removal of detritus from the river bed.

Channel sedimentation is one of the important engineering problems which must be solved by the district. While the laws governing the transportation of debris by running water are not generally understood, it is unanimously agreed that the scouring effect of a continuously maintained large flow is greater than that of occasional great floods. The matter of channel maintenance is important. It was thoroughly argued at hearings on the plan of reclamation sponsored by Messrs. Tibbals and Percival, and many agree that deficiencies in this regard accounted for the failure of the plan.

Partial use of flood channel.—The revenue resulting from use of portions of the flood channel may properly be expected to yield a revenue to the state. It becomes apparent that, with regulation, the frequency of floods in excess of the capacity of the present river channel will be greatly decreased and that some of the flood channel lands may be put to a practically continuous agricultural use. The limited industrial use which may be had for lands subject to intermittent floods will also be extended.

Decreased length of bridges.—Regardless of the width of flood channel adopted, all obstructions to flow must be removed. The existing railroad fills must be replaced by trestles and where necessary the grades must be raised to conform to the proposed flood planes. While the advantages of the lesser channel width are obvious, the district at this time is not prepared to make a statement as to the allocation of these costs.

The highway leading northerly from the Twelfth Street Bridge is one of the main arteries of travel from Sacramento and traffic counts have indicated that between 11,500 and 12,000 vehicles pass over it every day. To obviate grade crossings at the two railroad intersections, subways have been constructed. These are flooded whenever the American River leaves its banks and a flood discharge which might otherwise do very little damage suspends traffic for several days after the high water has receded. For this reason, the present location is regarded as temporary. If the 2400-foot flood channel is found necessary, the Highway Commission proposes an elevated structure passing over the railroad tracks with a maximum height above ground of about 45 feet. With the 1000-foot channel the present location can be used, it being necessary only to substitute a short trestle between the Twelfth Street Bridge and the proposed levee.

The Highway Commission engineers have estimated the cost of the long overhead crossing at $787,000. The shorter structure would cost less than $100,000, making the saving on this item alone $687,000.

Aside from matters pertaining to cost and maintenance, decreased lengths of trestles are desirable from the point of view of the traveling public. Causeways are dangerous, time consuming and subject to congestion. They represent most of the detrimental features which highway engineers endeavor to avoid and in these cases are particularly obnoxious on account of the density of traffic.

Loss of assessable area.—The wider flood channel which will be necessary without reservoir regulation, will contain approximately 15 per cent of the total area of the district. Land along the river, being lowest in elevation, will probably be assessed at a maximum rate. It therefore

appears that the loss in assessed valuation through adoption of the wider channel may approach 25 per cent of the total for the district. This, of course, has the effect of increasing the charges against the remaining area and to that extent renders the acceptance of the project by the people more doubtful.

Regardless of its width any flood channel along the American River will constitute an eyesore and will forever be a barrier to the development of the two municipalities. As their expansion continues, this area will become more valuable and the economic loss will become more acute and more obvious. Many broad visioned people anticipate the ultimate consolidation of the two cities and in view of the rate of expansion in the last decade it seems not unreasonable to believe that such a consolidation will receive serious consideration within the next few years. A wide flood channel will go far toward defeating such a movement.

Improved chance for passage of bond issue. The benefits from flood protection become tangible only at infrequent intervals, and except in times of stress, it is difficult to impress upon the average voter the desirability and necessity for such protection. Herein lies the district's greatest problem. During the last few years, the people of Sacramento have rejected in whole or in part several issues, all of which provided for the construction of works which would have been tangible in aspect and of continuous and definite use to the taxpayer. No less than three bond issues will have been presented during 1928 and if any are successful, taxation must be increased. Other issues being contemplated for 1929, the district must face unfavorable psychological reactions resulting from them.

It seems obvious that, to be successful, the cost of the project must be held to an absolute minimum. This is possible only with regulation by reservoirs. The people of the district are quite generally aware that such regulation is feasible and economical and failure of the negotiations between the state and Kieffer et al. will have a decidedly adverse effect upon the chances for the success of a bond election.

Urgency of the situation.

Those interested in flood abatement, salinity control and irrigation supply have given practically unanimous endorsement to the coordinated water conservancy plan which is now being given careful study by your committee. All recognize the many difficulties in its consummation, but all are principally concerned with the matters of cost and time element.

As regards flood regulation and salinity control the situation amounts to an emergency. The position of American River Flood Control District certainly demands prompt action and obviously enough of the land holders of the delta can not and will not tolerate an indefinite continuance of the situation which has been forced upon them. The solution offered by the proposed major project on the American River is to all practical purposes, immediate in its effects; it requires very little or no expenditure of public funds and, if shrewdly handled, can be put into operation in such a manner as to insure lasting benefits to the state.

The conditions which obtained at the time of the enactment of the so-called Folsom bill have radically changed. The flood discharge upon

which the State Reclamation Board and California Debris Commission designed its plans was 128,000 second-feet; the flood of March, 1928, at its crest exceeded 180,000 second-feet. An unexpected element has been introduced by the proposed upper reservoirs, which combined with the Folsom plan would appear to offer a final solution to both flood and salinity problems. Unanticipated difficulties have been encountered in reconciling the economics of the project with existing legislation, the burdens specifically imposed being greater than the prospective revenue from power appears to warrant.

A suggestion has been made as to the propriety of securing legislation at the coming session, to validate any contract which may be made with the private interests involved in the American River situation and to effect the formation of the delta district proposed by Mr. Hadsell. We can conceive no legislation more essential under existing conditions or more broadly beneficial to the Sacramento Valley and we can not refrain from earnestly recommending such action.

Conclusions.

1. It is believed that immediate public policy can be better served by storage on the American River, than on the Sacramento; this belief being founded on the following grounds:

(a) There would be no interference with the passage of water intended for salinity control. A regulated flow of 4000 second-feet being possible during seasons of critical salinity, the delta region will be freshened nearly to the Sacramento Short Line ferry.

(b) Protection from inundation will be afforded to the thickly settled and rapidly growing city of North Sacramento, which is now wholly unprotected. Ultimate regulation to a maximum flow of 60,000 second-feet being possible, the American River problem will be solved and a menace to the city of Sacramento will be definitely removed.

(c) A great block of power will be made available at a cost not in excess of that to be produced by proposed upper Sacramento developments.

2. It is believed that the state is confronted with a situation having all the aspects of an emergency:

(a) The delta interests will no longer tolerate the destruction of property and loss of income due to the encroachment of salt water and unless some definite and constructive measures are adopted toward ameliorating the situation, disastrous litigation will ensue.

(b) A determination in the matter of American River Flood Control District must be had at the earliest possible moment and unless a reduction of cost is made possible through storage regulation the people will probably reject the project.

(c) Construction of storage works by the state is so uncertain and so subject to delay as to warrant its rejection as a possible solution. The introduction of a political football into the situation will in no measure benefit the parties now injured or subject to injury.

3. A solution of the obstacles to the signing of a contract with some responsible organization should be diligently sought and, if the solution is not found, the obstacles should be removed by further legislative enactment.

(a) Some such contract is the key to the entire situation. No one can foresee the course of events or anticipate the outcome of controversial

elements contained in a discussion of the coordinated plan of water development.

(b) Such a contract clears the way for the consummation of the larger project which to the best of our present knowledge, solves this important problem which now confronts the state.

(c) The American River project involves no great expenditure of public funds and its benefits may be had with a minimum of delay.

Respectfully submitted.

A. M. BARTON,
Chief Engineer and General Manager,
State Reclamation Board.

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REPORT

OF THE

State Narcotic Committee

State of California

JANUARY 1, 1929

64412

REPORT OF THE STATE NARCOTIC COMMITTEE CREATED BY SENATE CONCURRENT RESOLUTION No. 20

His Excellency, C. C. YOUNG,
Governor of the State of California.

In fulfillment of our obligations under Senate Concurrent Resolution No. 20, after a thorough and careful study of the narcotic situation in California, we hereby hand you our report and recommendations.

SANBORN YOUNG, Chairman,
THOMAS J. LENEHAN, Secretary,
E. H. CHRISTIAN,
Z. S. LEYMEL.

SENATE CONCURRENT RESOLUTION No. 20

CHAPTER 84

Senate Concurrent Resolution No. 20—Relative to the suppression of traffic in narcotic drugs and authorizing the appointment of a committee to confer with commissions from the states of Oregon and Washington for the purpose of considering and recommending the enactment of effective and uniform laws governing the traffic in narcotic drugs and related matters.

[Filed with Secretary of State April 29, 1927]

WHEREAS, The misuse of habit forming drugs constitutes a grave menace to society; and

WHEREAS, There is great need for more vigorous action on the part of the State of California to combat this evil; and

WHEREAS, The states of Washington, Oregon and California are particularly subject to the illegal traffic in narcotic drugs on account of their accessibility through the various ports; and

WHEREAS, A united action on the part of these states is essential in order to combat this evil; now, therefore be it

Resolved by the Senate of the Legislature of the State of California, the Assembly concurring, That there shall be and hereby is created a committee to consist of two members of the Senate, to be appointed by the president of the Senate, two members of the Assembly, to be appointed by the speaker of the Assembly, and one citizen of the State of California, to be appointed by the governor, said committee to act in the same manner as commissions from the states of Washington and Oregon, for the purpose of considering the enactment of effective and uniform laws governing traffic in narcotic drugs; be it further

Resolved, That the committee hereinabove named shall also consider the advisability of harmonizing state laws with federal narcotic laws in order to make possible closer cooperation between state and federal law enforcing officials; be it further

Resolved, That the committee shall also make a complete study pertaining to the proper treatment of narcotic drug addicts and shall gather such other necessary information, formulate recommendations, and prepare and submit to the next session of the Legislature of the State of California their findings therein; be it further

Resolved, That the members of said committee shall receive no compensation for their services but shall be paid their necessary traveling and other expenses. The sum of five hundred dollars is hereby set aside from the contingent fund of the Senate, and a like sum from the contingent fund of the Assembly, and made available for the purpose of defraying the expenses, if any, of such committee and committeemen, which expenses shall be paid equally from such contingent funds of the Senate and Assembly, and the state controller is hereby authorized and directed to draw his warrant in favor of the members of said committee for such expenditures as may be certified to him from time to time by said committee, and the state treasurer is hereby authorized and directed to pay the same.

Our committee begs leave to report that the state of Washington having failed to appoint a narcotic commission, no conferences between the states of Oregon, Washington and California were held; and no action was taken in reference to uniform state laws governing illegal traffic in narcotic drugs.

The resolution instructs our committee to bring about, if possible, closer cooperation between state and federal law enforcing officials. We are glad to report that we have been successful in securing better cooperation between the Federal Narcotic Division, Washington, D. C., and the State Board of Medical Examiners, through inducing the Treasury Department of the federal government to promulgate the following regulation:

(T. D. 26)

AUTHORIZING THE COMMISSIONER OF PROHIBITION TO GIVE INFORMATION IN CERTAIN NARCOTIC CASES TO STATE MEDICAL BOARDS, OR LIKE BODIES

Treasury Department,
Office of the Secretary of the Treasury,
Washington, D. C.

To Narcotic Agents in Charge, Narcotic Inspectors, Narcotic Agents, and Others Concerned

Requests are frequently made of this bureau by state medical boards, and like bodies to be furnished with evidence of violations of the Harrison Narcotic Laws, as amended, obtained by narcotic agents, against physicians, druggists, and others, for the purpose of aiding such boards, or like bodies, in taking appropriate action where there are violations of their state laws. Under the limitations of Articles 80 and 81, of Internal Revenue Regulations No. 12, which have heretofore governed the action of this bureau on the subject, such evidence has not been furnished, but it is now made to appear that, in many cases, to deny such requests is to refuse cooperation and assistance to state officers in faithful efforts, in proceedings under state laws, to punish violators of the Harrison Narcotic Laws.

The Commissioner of Prohibition may, therefore, in the exercise of a sound discretion, in the case of any person who has been convicted under the Harrison Narcotic Laws or who has made an offer in compromise thereunder which has been accepted, furnish to state medical boards and like bodies and to state law enforcement officers, upon written request such information as may, in his judgment, be of assistance to such state officials in the enforcement of their state laws.

J. M. Doran,
Commissioner.

Approved: April 4, 1928.
Ogden L. Mills,
Acting Secretary of the Treasury.

In the past we have had various cases of physicians who have violated the federal narcotic laws and compromised their cases by the payment of fines. These men were then permitted to continue practicing medicine in California as the evidence used against them was in the hands of the Federal Narcotic Division and the old regulation prevented them from divulging it.

Under regulation T. D. 26 it will be possible in the future for the State Board of Medical Examiners to secure the evidence of violation of federal narcotic laws in all compromised cases and if they see fit they can use this evidence and take away the license of these law violators to practice medicine in California. The following letter from the State Board of Medical Examiners has been received by the State Narcotic Committee:

San Francisco, California.
November 27, 1928.

Senator Sanborn Young, Chairman,
State Narcotic Committee,
Los Gatos, California.

Dear Senator Young: On behalf of the Board of Medical Examiners I wish to thank you for your continued keen interest in the narcotic enforcement problem.

We are particularly grateful for your kindly offices at Washington, we understanding that some time since, at your own expense, you made the trip to our nation's capital, where you interviewed those in charge of enforcing the Harrison Narcotic Act and were of material assistance in effecting a modification of the

heretofore inexorable rule denying to state medical examining boards information relative to violations of the Harrison Narcotic Act which had been settled by what is known as compromise, i.e., the acceptance by the government of a specific sum of money offered by some individual against whom evidence had been obtained showing more or less flagrant violation of the Harrison Narcotic Act.

Our concern in this regard arose, as you know, from our attempts to discipline certain doctors of medicine under the Medical Practice Act of California, whose cash offer of settlement in compromise to the government had been accepted, the government officials thereafter refusing to give us any information regarding the cases settled by such compromise, thus making it impossible for the Board of Medical Examiners to take any action in disciplining such offenders.

Again expressing our appreciation of your good work and cordial cooperation, believe us

Very truly yours,

CHARLES B. PINKHAM, M.D.,
Secretary-Treasurer.

The state narcotic committee which served from 1925 to 1927 published a report on drug addiction in California. After a comprehensive and exhaustive study of the entire problem they recommended a creation of an addicts' farm for the segregation and care of not a few, but all of the addicts of the state that could be apprehended. They advised a farm of sufficient size to take care of from 1000 to 1500 drug addicts. The purpose of the farm was threefold:

First: To cure permanently as many addicts as possible.

Second: To put the drug peddler out of business by segregating drug addicts for a long period of time and thus destroying the peddlers' market by removing his customers.

Third: To prevent the spread of drug addiction because drug addiction is spread by the association of addicts with other people.

This comprehensive plan failed of realization because of the large appropriation required to put it into effect. A substitute bill was enacted into law which carried no appropriation and under this measure the state hospital at Spadra has been created.

THE STATE NARCOTIC HOSPITAL AT SPADRA

For reasons of economy the grounds and buildings of the old Pacific Colony, located about five miles from Pomona, were utilized for the State Narcotic Hospital. The grounds consist of some 800 acres of rolling land and the buildings, which have been nicely remodeled and equipped, are adequate and suitable to care for approximately eighty addicts. Unfortunately the location provides neither natural nor artificial barriers against either the escape of the addicts or the smuggling of narcotic drugs from without into the institution. This is a very serious defect and we recommend that it be immediately corrected. The third biennial report of our State Department of Institutions, on page 119, gives record showing that in our state hospitals, where no barriers are set up to prevent the escape of drug addicts during their treatment, approximately 40 per cent escaped. In the judgment of your committee it is only due to the unusual personal character and executive ability of Dr. Joyce and to the excellent food and care and the comfortable quarters and pleasant surroundings of the hospital that not more than eight addicts have escaped to date.

Dr. Joyce has no means of enforcing authority and discipline except through moral suasion. This, in our judgment, is a grave error and will cause serious trouble in the future. Among the addicts are men guilty of felony and other serious violation of our law, and we look with concern upon the complete lack of power and authority to enforce discipline among the inmates of the institution.

TREATMENT GIVEN DRUG ADDICTS AND PROBABLE RESULTS

Dr. Carlton Simon, who has contacted with many thousands of addicts while at the head of the New York City Police Narcotic Division, and Peter Clarke, who has been associated with him, tell us that the physical cure of the addict is only 10 per cent of a permanent cure, and that 90 per cent is the mental, moral or spiritual strengthening of character with a force that will always be available at any time of weakness or temptation; also in the complete elimination of the cause of the downfall of the addict in the first place. They divide the cure into three steps:

First: The physical cure.
Second: The personality cure.
Third: The follow-up and after-care system.

The first step, the physical cure, is successfully given at our state hospital. The treatment given there is equal to that given in the best private sanitariums, and superior to that given in any other state or city institution. It is humane, scientific and successful; but it ends with a completion of the first step, and the second and third steps have not yet been undertaken. The value of the experiment will depend upon the wisdom and energy with which this portion of the problem is attacked. The only possibility of success in making any permanent cures is to give the same care and attention to the 90 per cent of the cure that we are now giving to the 10 per cent, namely, to give the same attention to the personality cure meaning the mental, moral or spiritual unlift and to the follow-up and after care system meaning the keeping in touch with the addict after leaving the hospital and coming to his assistance in times of temptation; and as far as possible eliminating the cause of his first resorting to narcotic drugs.

In order to accomplish this your committee recommends that a so-called personality director be associated with Dr. Joyce whose duty will be to devote himself to the personality cure and to the follow-up and after-care system. Your committee feels that the importance of this addition is vital if our California State Narcotic Hospital is to prove an exception to the long list of failures in such public institutions for the permanent cure of drug addiction.

STATE NARCOTIC DIRECTOR

The law passed at the last session of our legislature creating a State Narcotic Director and staff of narcotic officers under him has resulted in improved conditions and is especially valuable in the carefully kept records of the Department which in the near future will permit us to displace theory and guesses with facts gained from the knowledge of the results.

Mr. Frank Benson, our Narcotic Director, is bringing a trained, legal mind together with much earnestness of purpose to bear upon the problem of drug addiction in California. Miss Theresa Meikle is making an enviable record as attorney for the department in San Francisco, and Captain J. A. Plank has established an admirable system of statistics of cases coming under the supervision of the department.

THE COURTS

The previous narcotic committee in their report published in 1926 commented adversely upon the records of our San Francisco police court judges. Since that time, however, we have received splendid cooperation from all of these police court judges. During the past two years, unfortunately, we have received little cooperation from our San Francisco superior court judges who have been trying cases of our State Poison Act violators. A review of their records for the first nine months of 1928 show that San Francisco superior court judges in 190 cases of narcotic violations by drug addicts and drug peddlers gave an average sentence of only six months, while during the same period Los Angeles superior court judges in 135 cases of the same character gave an average sentence of more than sixteen months in the county jail. From 100 cases of drug peddlers sent to our prisons in California between January 1st and December 10th only eight were sent there by San Francisco superior court judges.

A federal judge who comes frequently to California to hold court makes the enforcement of the Harrison Narcotic Act very difficult by his claim that a drug peddler is only guilty of avoiding the payment of a small customs tax levied on narcotic drugs. This judge sentences vicious drug peddlers to pay a small fine or spend a few days in jail for failure to pay the customs tax. Upon the same evidence in similar cases other federal judges give sentences ranging from two to ten years in the penitentiaries. Fortunately, no other judge in the country agrees with this one, otherwise our whole warfare to prevent the smuggling into our country of vast quantities of narcotic drugs would be of no avail. Owing to weak and inadequate laws in many of our states drug addiction would become prevalent and our country would be the drug peddlers' paradise.

GENERAL CONDITIONS

While no headway in suppression of narcotic drugs in this country has been made by our federal narcotic officials and the situation continues very bad, nevertheless we believe that the census of the drug addicts in California is somewhat smaller than at the time of the last State Narcotic Committee Report in 1926. This decrease is due to the splendid enforcement of our narcotic laws in Los Angeles and the good work accomplished by our newly created State Narcotic Division, the peace officers throughout California and the Federal Narcotic Division.

The State Board of Medical Examiners headed by Dr. P. T. Phillips and Dr. C. B. Pinkham have contributed in no small measure to this decrease of drug addiction in California.

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REPORT

OF

California State Bureau

OF

Criminal Identification and Investigation

FOR THE BIENNIAL PERIOD ENDING JUNE 30, 1928

CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1928

61980

LETTER OF TRANSMITTAL

Sacramento, August 30, 1928.

To His Excellency,
C. C. Young, *Governor,*
Sacramento, California.

We take considerable pride in presenting to you the report of the Superintendent of the Bureau of Criminal Identification and Investigation, and particularly call your attention to the statistical report which is appended thereto.

It will be observed from the statistical and superintendent's reports that the bureau is functioning more efficiently than was predicted by its promoters. The bureau, during the past year, has been installed in new quarters which are well lighted and peculiarly adapted for the work at hand. Adequate provisions have been made for the bureau employees to conduct their business under most favorable working conditions.

We believe that additional employees should be provided the bureau in order that the superintendent may carry out one of the original purposes, namely, the filing of all pawnshop records in this central clearing house for criminal records. It is true that over half a million dollars worth of property was recovered by the bureau during the past two years, but with an extension of the work, we feel reasonably certain that the amount may be considerably increased. Approximately fifteen additional clerks will be needed to type and file all second-hand and pawnshop records, and records of lost and stolen property which are reported to the bureau during the year.

We are of the opinion that the arm of the law may be considerably strengthened by attaching to the bureau a Section of Investigation, this section to consist of professionally trained criminal investigators who would confine their efforts entirely to the investigation of major crimes committed in the state. These investigators would assist municipalities and counties when called upon by officials and would also take up the pursuit of habitual criminals known to be operating in the state. In this connection, it should be noted that investigators of this character would not be used for the investigation of minor crimes, but only for major crimes or the activities of habitual criminals.

Attention is called to the need for closer coordination of the existing law enforcement agencies now organized for the purpose of suppressing crime. This may be accomplished by the use of appliances for communicating with all departments through a central agency. The Teletype offers the means for rapid apprehension and identification of criminals. This means of communication is absolutely necessary in this period where rapid transportation facilities are at hand for any person, and where the criminal operating in a southern city one day may operate in a northern city the next. Roads are constantly used by criminals to travel from one city to another. The Teletype offers a method of keeping check on their activities. It has been suggested that

this is the business of the several counties, but statewide Teletype service is impossible without the aid of the state. The central distributing plant should be placed in the Bureau of Criminal Identification and Investigation, and the superintendent should have the power to direct the type of messages that would be permitted to be transmitted over the system. The Teletype may be used as a means of communicating lists of automobiles stolen each day throughout the state; descriptions of major offenders who are wanted by officials in and out of the state; also it may be employed to transmit information of importance to peace officials.

The business of apprehending and identifying criminals is growing more and more difficult each year. Criminals are not the stupid, idiotic individuals that some people believe them to be, but in many cases are crafty and difficult to apprehend. They do not hesitate to employ scientific methods, and during the past few years such methods actually have been employed by them in the commission of crimes and in destroying the evidence thereof.

We, therefore, believe that a scientific laboratory should be attached to the state bureau, wherein all problems referable to the chemical analyst and ballistic expert may be sent for examination. Such a laboratory would supply to the most remote community the very best scientific service. At least two and possibly three employees would be necessary to put the laboratory on a working foundation.

California has cause to be proud of the bureau as it is now conducted and maintained. Its achievements since the day of its creation have been outstanding. The board, however, believes that this state can be served better by an extension of the bureau's activities, facilities and equipment.

In conclusion, we desire to express our deep appreciation to you and your entire administration for the interest manifested and support accorded to the bureau.

BOARD OF MANAGERS,
STATE BUREAU OF CRIMINAL IDENTIFICATION
AND INVESTIGATION.

August Vollmer, *President*.
Earl Warren.
C. L. Gillett.

REPORT OF SUPERINTENDENT CALIFORNIA STATE BUREAU OF CRIMINAL IDENTIFICATION AND INVESTIGATION

Sacramento, August 6, 1928.

Honorable Board of Managers,
State Bureau of Criminal Identification and Investigation,
Sacramento, California.

GENTLEMEN: Report of the work of the bureau for the biennial period ending June 30, 1928, is submitted herewith. Exceedingly large dividends, in proportion to the amount invested by the state for the support and maintenance during the past two years, have been returned to the taxpayers through the recovery and return to rightful owners of stolen and embezzled property, valued in excess of a half-million dollars. Information leading to the recovery of the above amount of property was due directly and indirectly to the efforts of the bureau.

Of the 98,535 finger print records of persons arrested, received in the bureau for classification and comparison, 42,667 were identified and verified as being habitual law offenders. These identifications have unquestionably effected an additional saving of thousands of dollars to the state in the number of and expense incidental to jury trials. Reports of felonious crimes committed within the state numbering 132,685 were received, analyzed and filed according to the method of operation employed by the perpetrator of the crime. A great many of these cases have been solved and the perpetrators apprehended through identifications furnished directly through the modus operandi system maintained by the bureau.

Forgers and fraudulent check operators numbering 3296 were identified and verified by the handwriting appearing upon questioned documents submitted to the handwriting and laboratory section of the bureau for examination. In the majority of these cases, these identifications were of great value to police officials in effecting the immediate apprehension of the guilty delinquents.

Of those identified as habitual offenders 970 were either escapes, parole violators, or fugitives from justice; many of them were escapes from penal institutions outside this state. Identification led to their extradition and return to the respective institutions from which they escaped, thereby eliminating the expense of prosecution and confinement in California prisons.

The amount of work accomplished by the bureau during the past two years is indeed noteworthy, and the results obtained are remakable when one takes into consideration the vastly magnified crime situation and the almost meager provision existing to handle the increase. In the lost and stolen section alone, for the 81st and 82d fiscal years, with additional clerical labor which has been requested in the biennial budget (to index, segregate, search and file the enormous number of reports received), the bureau could identify and cause to be returned to rightful owners property far in excess of the half-million dollars worth returned during the past biennial period.

On account of the large accumulation of finger print records in file, and the inevitable increase of finger prints received daily, it is impossible for the present force of finger print experts properly to classify, search and file the finger print records received by the bureau. Recently we had to request several out of state institutions (whose records of paroled and discharged delinquents are of inestimable value to crime prevention and apprehension in California) to refrain from sending us such records because of the limited number of finger print experts assigned to this work in the bureau, and due to their inability to do justice to both the records received from departments in the state and those received from out of state institutions.

The value of the single finger print system, compiled for the purpose of identifying criminals who leave this positive telltale evidence at the scene of their crime, has been proven beyond any question of a doubt, and additional employees are necessary for the extension of this system.

The operation of the modus operandi section suffers similarly. Many crimes have been solved, and the habitual offenders who commit a particular crime (and in doing so employ some peculiar method by which they can be identified) have been brought to justice through information developed by this system and furnished to peace officials. With a few additional employees, this system could be elaborated upon and many more crimes could be solved.

The number of identifications in the handwriting and laboratory section could be increased very materially through the addition of another handwriting expert and a junior handwriting expert. The monetary loss to business men in this state, through the medium of fraudulent and forged checks, is enormous. Increasing the personnel of this section will mean greater efficiency in the identification and apprehension of this class of delinquents, thereby cutting down their period of criminal activity.

The number and nature of specimens of evidence received at the bureau for chemical and microscopical examination and anaylsis most assuredly justifies the installation of a well equipped laboratory and the employment of a chemist and a consulting expert thoroughly familiar with cases involving firearms, ammunition and ballistics.

The task of compiling valuable statistical data regarding the operations of the bureau has heretofore been assigned to a clerk in the bureau. However, the growth of the number and nature of records, reports, etc., received, together with other statistics concerning crimes and criminals (which would be of incalculable value in reducing crime) has reached the point when it is essential that a qualified statistician be employed for this work.

Your attention is called to the fact that the State Civil Service Commission recently made a survey and reclassification of the scientific and technical positions in the bureau. A very appropriate readjustment of salaries for these positions also was adopted by this body. The positions and salaries are set forth as follows:

	Salary inclusive
Identification expert (superintendent of the bureau)	$300 to $400
Handwriting expert	215 to 290
Modus operandi expert	200 to 275
Finger print expert	175 to 250

	Salary inclusive
Junior handwriting expert	160 to 200
Junior modus operandi expert	150 to 190
Junior finger print expert	140 to 170

The equipment and supplies necessary to maintain the present efficiency of the bureau and partially to provide for the anticipated increase, together with the number of additional employees essential appropriately to carry out the functions of the bureau as outlined, will require an appropriation of $61,461.54 in excess of the previous biennial budget.

In conclusion, I desire to thank the honorable board of managers of the bureau, executive officials of the state, all peace officers and identification experts of the United States, Canada and other foreign countries, for their kind assistance and cooperation, without which the bureau would have been seriously handicapped.

Respectfully submitted.

C. S. Morrill,
Superintendent.

General Summary

Biennial Period Ending June 30, 1928

Value of stolen property identified through bureau and returned to rightful owners	$550,000.00
Identifications by finger print section	21,910
Identifications by laboratory and research section	561
Identifications by modus operandi section	26
Identifications of unknown dead	31
Identifications for foreign departments	4,064

Analytical Summary by Sections

CORRESPONDENCE AND AUDITING SECTION

Correspondence received	24,759
Correspondence dispatched	77,460
Telegrams received	720
Telegrams dispatched	801
Telephone calls received	2,088
Telephone calls dispatched	1,269
Appropriation for 1926-1927—1927-1928	$79,721.41
Expenditures	72,063.13
Balance of appropriation	$7,658.28

MODUS OPERANDI SECTION

Circulars received	5,772
Crime reports received	126,913
Geographical index cards filed	7,606
Individual files of important cases filed	1,363
Individual record cards filed	6,399
Modus operandi cards filed	49

FINGER PRINT SECTION

Anatomical index cards filed	2,943
Criminal index cards filed	100,779
Finger prints received	98,535
Finger prints received and filed by request (not criminal)	5,055
Finger prints of unknown dead received	225
Criminal photographs received	82,709
Latent finger prints developed at scene of crime	311
Identifications by English descriptive	268
Identifications by finger prints	21,642
Identifications by latent finger prints	1
Identifications by modus operandi	26
Identifications by recognition	2
Identifications of unknown dead	31
Identifications for foreign departments	4,064
Verifications by finger prints	16,691

LABORATORY AND RESEARCH SECTION

Questioned documents examined	14,975
Handwriting signatures filed	1,077
Enlargements made	42
Negatives made	317
Photographic prints made	1,191
Identifications by handwriting	560
Verifications by handwriting	2,646
Checks copied	440

LOST, STOLEN AND PAWNED PROPERTY SECTION

Lost, stolen or embezzled articles indexed and filed	10,851
Pawned articles filed	95,199
Stolen automobiles identified	2,630
Stolen miscellaneous articles identified	247
Value of property identified	$550,000 00

GRAND TOTAL OF RECORDS ON FILE

CORRESPONDENCE SECTION

Correspondence received to July 1, 1926	6,948
Correspondence received from July 1, 1926, to June 30, 1927	7,632
Correspondence received from July 1, 1927, to June 30, 1928	17,127
Grand total of correspondence received	31,707
Correspondence dispatched to July 1, 1926	49,195
Correspondence dispatched from July 1, 1926, to June 30, 1927	34,400
Correspondence dispatched from July 1, 1927, to June 30, 1928	43,060
Grand total of correspondence dispatched	126,655
Telegrams received to July 1, 1926	516
Telegrams received from July 1, 1926, to June 30, 1927	259
Telegrams received from July 1, 1927 to June 30, 1928	461
Grand total of telegrams received	1,236

Telegrams dispatched to July 1, 1926	644
Telegrams dispatched from July 1, 1926, to June 30, 1927	329
Telegrams dispatched from July 1, 1927, to June 30, 1928	472
Grand total of telegrams dispatched	1,445
Telephone calls received to July 1, 1926	2,527
Telephone calls received from July 1, 1926, to June 30, 1927	1,300
Telephone calls received from July 1, 1927, to June 30, 1928	788
Grand total of telephone calls received	4,615
Telephone calls dispatched to July 1, 1926	2,288
Telephone calls dispatched from July 1, 1926, to June 30, 1927	618
Telephone calls dispatched from July 1, 1927, to June 30, 1928	651
Grand total of telephone calls dispatched	3,557

MODUS OPERANDI SECTION

Circulars on file July 1, 1926	22,475
Circulars filed from July 1, 1926, to June 30, 1927	3,162
Circulars filed from July 1, 1927, to June 30, 1928	2,610
Grand total of circulars on file	28,247
Geographical index cards on file July 1, 1926	23,071
Geographical index cards filed from July 1, 1926, to June 30, 1927	3,808
Geographical index cards filed from July 1, 1927, to June 30, 1928	3,799
Grand total geographical index cards on file	30,678
Individual files of important cases on file July 1, 1926	1,832
Individual files of important cases filed from July 1, 1926, to June 30, 1927	665
Individual files of important cases filed from July 1, 1927, to June 30, 1928	698
Grand total of individual files of important cases on file	3,195
Individual record cards on file July 1, 1926	23,979
Individual record cards filed from July 1, 1926, to June 30, 1927	2,516
Individual record cards filed from July 1, 1927, to June 30, 1928	3,883
Grand total of individual record cards on file	30,378
Modus operandi cards on file July 1, 1926	953
Modus operandi cards filed from July 1, 1926, to June 30, 1927	34
Modus operandi cards filed from July 1, 1927, to June 30, 1928	15
Grand total of modus operandi cards on file	1,002

FINGER PRINT SECTION

Anatomical index cards on file July 1, 1926	6,839
Anatomical index cards filed from July 1, 1926, to June 30, 1927	1,425
Anatomical index cards filed from July 1, 1927, to June 30, 1928	1,518
Grand total of anatomical index cards on file	9,782
Bertillon cards on file July 1, 1926	333
Bertillon cards filed from July 1, 1926, to June 30, 1927	—
Bertillon cards filed from July 1, 1927, to June 30, 1928	—
Grand total of Bertillon cards on file	333
Criminal index cards on file July 1, 1926	290,881
Criminal index cards filed from July 1, 1926, to June 30, 1927	45,395
Criminal index cards filed from July 1, 1927, to June 30, 1928	55,384
Grand total of criminal index cards on file	391,660
Finger print cards on file July 1, 1926	163,422
Finger print cards filed from July 1, 1926, to June 30, 1927	46,940
Finger print cards filed from July 1, 1927, to June 30, 1928	51,595
Grand total of finger print cards on file	261,957
Criminal photographs on file July 1, 1926	189,653
Criminal photographs filed from July 1, 1926, to June 30, 1927	37,117
Criminal photographs filed from July 1, 1927, to June 30, 1928	45,592
Grand total of criminal photographs on file	272,362
Finger prints filed by request to July 1, 1926	699
Finger prints filed by request from July 1, 1926, to June 30, 1927	1,745
Finger prints filed by request from July 1, 1927, to June 30, 1928	3,310
Grand total of finger prints filed by request	5,754

Latent finger prints on file July 1, 1926	308
Latent finger prints filed from July 1, 1926, to June 30, 1927	129
Latent finger prints filed from July 1, 1927, to June 30, 1928	180
Grand total of latent finger prints on file	617
Identifications by English descriptive to July 1, 1926	602
Identifications by English descriptive from July 1, 1926, to June 30, 1927	116
Identifications by English descriptive from July 1, 1927, to June 30, 1928	152
Grand total of identifications by English descriptive	870
Identifications by finger prints to July 1, 1926	33,825
Identifications by finger prints from July 1, 1926, to June 30, 1927	9,884
Identifications by finger prints from July 1, 1927, to June 30, 1928	11,758
Grand total of identifications by finger prints	55,467
Identifications by latent finger prints to July 1, 1926	10
Identifications by latent finger prints from July 1, 1926, to June 30, 1927	1
Identifications by latent finger prints from July 1, 1927, to June 30, 1928	------
Grand total of identifications by latent prints	11
Identifications by modus operandi to July 1, 1926	22
Identifications by modus operandi from July 1, 1926, to June 30, 1927	15
Identifications by modus operandi from July 1, 1927, to June 30, 1928	11
Grand total of identifications by modus operandi	48
Identifications by recognition to July 1, 1926	101
Identifications by recognition from July 1, 1926, to June 30, 1927	2
Identifications by recognition from July 1, 1927, to June 30, 1928	------
Grand total of identifications by recognition	103
Identifications of unknown dead to July 1, 1926	36
Identifications of unknown dead from July 1, 1926, to June 30, 1927	17
Identifications of unknown dead from July 1, 1927, to June 30, 1928	14
Grand total of identifications of unknown dead	67
Identifications for foreign departments to July 1, 1926	6,484
Identifications for foreign departments from July 1, 1926, to June 30, 1927	1,930
Identifications for foreign departments from July 1, 1927, to June 30, 1928	2,134
Grand total of identifications for foreign departments	10,548
Verifications by finger prints to July 1, 1926	32,283
Verifications by finger prints from July 1, 1926, to June 30, 1927	7,343
Verifications by finger prints from July 1, 1927, to June 30, 1928	9,348
Grand total of verifications by finger prints	48,974

LABORATORY AND RESEARCH SECTION

Questioned documents examined to July 1, 1926	35,257
Questioned documents examined from July 1, 1926, to June 30, 1927	7,906
Questioned documents examined from July 1, 1927, to June 30, 1928	7,069
Grand total of questioned documents examined	50,232
Handwriting signatures filed to July 1, 1926	8,691
Handwriting signatures filed from July 1, 1926, to June 30, 1927	545
Handwriting signatures filed from July 1, 1927, to June 30, 1928	532
Grand total of handwriting signatures on file	9,768
Microscopic analysis made to July 1, 1926	160
Microscopic analysis made from July 1, 1926, to June 30, 1927	79
Microscopic analysis made from July 1, 1927, to June 30, 1928	--
Grand total of microscopic analysis made	239
Enlargements made to July 1, 1926	359
Enlargements made from July 1, 1926, to June 30, 1927	28
Enlargements made from July 1, 1927, to June 30, 1928	14
Grand total of enlargements made	401
Negatives made to July 1, 1926	2,645
Negatives made from July 1, 1926, to June 30, 1927	123
Negatives made from July 1, 1927, to June 30, 1928	194
Grand total of negatives made	2,962
Photographic prints made to July 1, 1926	9,363
Photographic prints made from July 1, 1926, to June 30, 1927	534
Photographic prints made from July 1, 1927, to June 30, 1928	657
Grand total of photographic prints made	10,554

Identifications made by handwriting to July 1, 1926	1,086
Identifications made by handwriting from July 1, 1926, to June 30, 1927	283
Identifications made by handwriting from July 1, 1927, to June 30, 1928	277
Grand total of identifications made by handwriting	1,646
Verifications made by handwriting to July 1, 1926	3,539
Verifications made by handwriting from July 1, 1926, to June 30, 1927	1,190
Vertifications made by handwriting from July 1, 1927, to June 30, 1928	1,456
Grand total of verifications made by handwriting	6,185
Checks copied to July 1, 1926	402
Checks copied from July 1, 1926, to June 30, 1927	238
Checks copied from July 1, 1927, to June 30, 1928	202
Grand total of checks copied	842

LOST, STOLEN AND PAWNED PROPERTY SECTION

Lost, stolen or embezzled articles indexed and filed to July 1, 1926	88,591
Lost, stolen or embezzled articles indexed and filed from July 1, 1926, to June 30, 1927	5,012
Lost, stolen or embezzled articles indexed and filed from July 1, 1927, to June 30, 1928	5,839
Grand total of lost, stolen or embezzled articles on file	99,442
Pawned articles filed to July 1, 1926	715,917
Pawned articles filed from July 1, 1926, to June 30, 1927	62,533
Pawned articles filed from July 1, 1927, to June 30, 1928	32,666
Grand total of pawned articles on file	811,116
Stolen automobiles identified to July 1, 1926	2,845
Stolen automobiles identified from July 1, 1926, to June 30, 1927	1,250
Stolen automobiles identified from July 1, 1927, to June 30, 1928	1,375
Grand total of stolen automobiles identified	5,470
Stolen miscellaneous articles identified to July 1, 1926	1,523
Stolen miscellaneous articles identified from July 1, 1926, to June 30, 1927	140
Stolen miscellaneous articles identified from July 1, 1927, to June 30, 1928	107
Grand total of stolen miscellaneous articles identified	1,770

CRIME, RACE AND SEX OF CALIFORNIA ARRESTS FOR FISCAL YEARS

1923–1924, 1924–1925, 1925–1926, 1926–1927, 1927–1928

Crime	1923 1924	1924 1925	1925 1926	1926 1927	1927 1928
Abandonment	87	10	187	418	658
Abduction	1	9	2	42	74
Abortion	3	2	10	13	5
Adultery	48	47	29	36	50
Arson	39	63	87	79	122
Assault—Felony	559	641	601	737	806
Assault—Misdemeanor	28	106	289	343	440
Bigamy	53	50	49	54	53
Bribery	24	25	24	20	14
Burglary—First	2,148	2,580	2,526	2,822	3,512
Burglary—Second	44	30	12	3	5
Burglary—Safe	----	28	9	11	17
Carrying concealed weapons	18	270	261	215	339
Counterfeiting	25	33	21	26	53
Contributing delinquency of a minor	210	262	287	251	278
Crime against Nature	26	19	16	24	30
Defrauding inkeeper	33	43	45	68	132
Disturbing the peace	269	398	506	574	1,438
Embezzlement—Felony	359	285	225	263	124
Embezzlement—Misdemeanor	26	74	126	140	115
Escape	33	12	58	95	40
Explosives	----	1	----	----	5
Extortion	27	50	55	53	62
False impersonation	1	4	14	10	51
False pretenses	146	220	158	205	152
Felony	1,329	1,826	1,654	2,039	1,619
Forgery	622	722	919	998	1,159
Fictitious	891	1,086	1,125	1,233	1,514
Fraudulent	4	7	6	----	44
Fugitive	616	603	480	505	655
Incest	4	17	8	15	20
Indecent exposure	42	59	73	78	90
I. W. W.	270	50	6	5	3
Juvenile delinquency	3	32	35	81	127
Lascivious conduct	243	289	248	330	390
Mayhem	5	27	12	18	20
Misdemeanor	3,456	2,835	2,862	3,605	2,969
Murder	274	346	356	447	446
Narcotics	1,128	869	1,111	928	930
Obscene	----	11	4	4	81
Parole violator	32	52	65	131	285
Prohibition	546	1,272	1,707	2,065	4,762
Rape	431	649	611	648	740
Receiving stolen property	207	208	211	270	242
Robbery—First	1,050	1,210	1,190	1,337	2,229
Robbery—Second	8	37	4	10	2
Robbery—Bank	6	1	10	12	5
Seduction	14	10	8	12	21
Sodomy	36	23	36	25	67
Theft—Grand	1,422	1,943	2,200	2,045	2,447
Theft—Animal	3	16	1	2	9
Theft—Automobile	656	547	828	1,658	1,826
Theft—Confidence	46	73	84	71	21
Theft—Pickpocket	43	75	66	86	15
Theft—Petit	1,563	1,696	1,834	1,784	2,468
Threat—Offense	33	45	32	34	36
U. S. Laws	855	1,031	1,066	1,548	1,414
Vagrancy	1,677	2,222	2,842	3,348	5,707
	21,722	25,061	27,291	31,874	40,938
Race—					
Caucasian	17,779	20,193	21,449	24,658	33,343
Ethiopian	1,088	1,322	1,557	1,829	2,107
Indian or Mexican	2,424	3,015	3,581	4,627	4,451
Malay	166	237	242	273	500
Mongolian	265	294	462	487	537
	21,722	25,061	27,291	31,874	40,938
Sex—					
Female—Adult	----	1,426	1,661	2,098	3,095
Female—Juvenile	----	156	215	308	53
Male—Adult	----	18,463	20,442	23,943	30,436
Male—Juvenile	----	5,016	4,973	5,525	7,354
Female	1,192	----	----	----	----
Male	20,530	----	----	----	----
	21,722	25,061	27,291	31,874	40,938

STATEMENT OF EXPENDITURES FOR THE FISCAL YEARS 1926–1927 AND 1927–1928

	Materials and supplies		Salaries and wages		Service and expense		Property and equipment		Total	
	1926–1927	1927–1928	1926–1927	1927–1928	1926–1927	1927–1928	1926–1927	1927–1928	1926–1927	1927–1928
Superintendent			$3,600 00	$4,154 82	$916 82	$744 60			$4,516 82	$4,899 42
Clerical and other	$410 55	$138 45	25,530 87	26,118 35	193 57	44 71			26,134 99	26,301 51
Equipment							$2,190 95	$1,107 58	2,190 95	1,107 58
Photographer	68 25	13 16					822 17		891 12	13 16
Freight, cartage and express					61 21	8 80			61 21	8 80
Light, heat and water					82 59				82 59	
Postage					483 50	518 00			483 50	518 00
Printing	252 60	310 30							252 60	310 30
Telephone and telegraph					298 62	338 93			298 62	338 93
Rent					2,422 84				2,422 84	
Janitor					431 15	799 04			431 15	799 04
Totals	$732 10	$461 91	$29,130 87	$30,273 17	$4,839 30	$2,454 08	$3,013 12	$1,107 58	$37,766 39	$34,296 74

Total expenditures 1926–1927 and 1927–1928, $72,063.13.

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REPORT

OF THE

California Crime Commission

1929

COMMISSIONERS:

JAMES A. JOHNSTON, Chairman
W. A. BEASLY
BURON FITTS
W. H. HOLLAND
WILLIAM R. McKAY
JUSTIN MILLER
U. S. WEBB

CHRIS B. FOX, Secretary
Tribune Tower, Oakland, Cal.



64455

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REPORT OF THE CALIFORNIA CRIME COMMISSION

To the Governor and the Legislature of the State of California:

Pursuant to chapter 407 of the Statutes of 1927, the California Crime Commission herewith submits a report containing its findings, conclusions and recommendations relating to the crime situation in this state, accompanied by proposed legislation to carry the same into effect.

All of which is respectfully submitted.

James A. Johnston, *Chairman*,
W. A. Beasly,
Buron Fitts,
W. H. Holland,
William R. McKay,
Justin Miller,
U. S. Webb.

Chris B. Fox,
Secretary.

Dated January 7, 1928.

REPORT OF CALIFORNIA CRIME COMMISSION

Pursuant to the recommendation of the Commission for the Revision of Criminal Procedure in its report to the legislature in 1927, the following statute was enacted which created the California Crime Commission:

SENATE BILL No. 417

CHAPTER 407

An act creating the California Crime Commission, defining its duties, and making appropriation for its expenses.

(Approved by the Governor May 10, 1927.)

The people of the State of California do enact as follows:

SECTION 1. There is hereby created a commission to be known as the California Crime Commission.

SEC. 2. Said commission shall consist of a chairman and six other members, all to be appointed by the governor of California, and to hold office at his pleasure.

SEC. 3. It shall be the duty of the California crime commission to make a study of the entire subject of crime, with particular reference to conditions in the State of California, including causes of crime, possible methods of prevention of crime, methods of detection of crime and apprehension of criminals, methods of prosecution of persons accused of crime, the entire subject of penology, and, generally, to make a survey of the entire field of crime, and to report its findings, its conclusions and recommendations to the governor and the legislature of California, which will convene in the year 1929.

SEC. 4. The salary of the chairman and the salary of the secretary of said commission shall be fixed by the commission with the approval of the department of finance. The other members of such commission shall serve without salary, but all members of said commission shall be entitled to their expenses incurred in the performance of their duties.

SEC. 5. Said commission shall have power and authority to employ such expert and other assistance as in its judgment shall be necessary to the proper performance of its duties.

SEC. 6. There is hereby appropriated out of the general funds in the treasury of the State of California the sum of twenty thousand dollars for the expenses of said commission.

ORGANIZATION

Governor C. C. Young appointed the following members of the commission: James A. Johnston, Chairman; W. A. Beasly, Buron Fitts, W. H. Holland, William R. McKay, Justin Miller and U. S. Webb.

At the organization meeting of the commission held in Sacramento on October 13, 1927, Chris. B. Fox was appointed secretary.

INTRODUCTORY

The work of the commission has been supplemented to some extent by the work of the Commission for the Study of Problem Children, which was created by an act of the 1927 legislature (chapter 349). The commission is composed of seven members and has for its particular subject the study of juvenile delinquency. The California Crime Commission has also concerned itself with the study of juvenile delinquency and the causes of crime. It has held several joint meetings and cooperated with the Commission for the Study of Problem Children.

The commission determined to use every agency, facility and resource available, including the experience of other bodies created or organized for similar purpose. The commission began its study by reviewing the surveys made by other state commissions and following this line examined reports of the American Bar Association, American Law Institute, Missouri Crime Survey, Minnesota Crime Commission, Georgia Crime Survey, New York Crime Commsson, Cleveland Foundation, American Prison Association, Indiana State Conference Committee on Delinquency and the National Crime Commission.

Realizing the necessity of paying particular attention to conditions in the State of California, we communicated with every state, county and city official whose position and duties bring him in contact with crime in any of its phases or at any stage. This included justices of the Supreme and appellate courts, every superior court judge and every municipal and police judge; every district attorney, sheriff, coroner, police chief, probation officer and public defender; managing boards of state institutions, prison wardens, reformatory superintendents and indentification experts; United States judges, commissioners and attorneys; and, because of the importance of the factor of juvenile delinquency, we sent the same communications to every county superintendent of schools. We wrote to members of the Judicial Council, officers and governors of the State Bar and professors of law in the universities of this state.

We addressed ourselves to our United States senators and congressmen and to every member of the legislature, as we felt that in addition to their interest as legislators, many of them had views and opinions resulting from experience gained in other positions.

We also wrote to many persons not holding official positions but who have occasion to contact crime and criminals and court proceedings. In this latter group we included many physicians, psychiatrists, psychologists and educators.

To those with whom we corresponded and whose views and opinions were invited we always asked this question: "What, in your judgment, are the best measures to be taken, either by legislation or otherwise, to improve the administration of criminal justice and reduce crime in California?" Many responded in general terms, showing very genuine interest, some indicated deep study of the questions involved and a few offered concrete suggestions of practical value.

In the endeavor to secure information from officials who did not respond in writing, to uncover views that might be held by persons not holding official positions and to enable citizens generally to voice their opinions and offer suggestions, we held a number of public hearings in Los Angeles, San Francisco, Sacramento, Oakland, Berkeley, San Jose and other places.

We conferred with members of the faculties of the University of California and Stanford University, and held meetings in conjunction with sessions of the State Bar of California at Pasadena, the district attorneys in convention at Del Monte, the Conference of Social Agencies in Yosemite, State Hospital Superintendents at Ukiah and the State Peace Officers' Association in annual convention at San Bernardino.

The opinions expressed at the public hearings were summarized and included in the appendix to minutes of our meetings. The suggestions received in written communications were classified according to sub-

jects, summarized and studied. Specific questions were prepared in advance for discussion at the convention meetings with special groups.

The chairman of our commission visited the prison at Stillwater, Minnesota, for the purpose of investigating industrial developments in that institution. Mr. McKay visited several reformatory institutions in eastern states to learn the methods employed by them in segregating the youthful from the older and more hardened offenders. Dean Miller attended sessions of the National Crime Commission and the Criminal Law Section of the American Bar Association. Attorney General Webb, Judge Beasley, Mr. Fitts, Mr. Holland and Secretary Fox each executed special assignments in connection with our examination and study of proposals.

In the communications received and at the hearings held many opinions have been expressed, many theories advanced, many suggestions offered, a few practical remedies proposed. We have carefully considered every communication received and every suggestion tendered, keeping in mind always the necessity and advisability of being practical. Some things brought to our attention as supposedly requiring new legislation were found to be already covered by existing law. This provokes the thought and comment that the understanding and enforcement of old laws is as much needed and may be as effective as the passing of new ones.

At any rate we are not inclined to hasty drafting of new legislation, not disposed to tinker unnecessarily with the present laws, or to make useless changes in the codes, nor to add to the number of statute crimes; therefore we have submitted all suggestions and proposals to this test: Is this likely to prevent, reduce or minimize crime; make it more difficult to commit crime; or escape its consequences?

The legislation that we are recommending aims at these points: to prevent crime in the first instance; to prevent the repetition of crime by those who have already offended once; to prevent opportunity for committing crime by those who have offended and who seem likely to continue in a course of crime.

The Commission offers the following bills and suggestions for your consideration:

EDUCATION

The Commission submits and recommends the enactment of three bills relating to the determination of ability and aptitude in public schools. One bill amends section 1683 of the Political Code, relating to public schools, one amends section 1751 of the Political Code relating to high schools and another amends section 4 of the part-time vocational opportunities act of May 27, 1919.

We are finding anew what every investigator and every commission seeking crime causes has discovered before, that crime is committed by the very young, many of them rash, reckless and bold, while still in their teens. Examination of case histories show frequent instances of many offenses preceding the first conviction and the records of apparently hardened though youthful offenders show known delinquency traceable back into childhood. The desperate bandit of today is the delinquent of yesterday, the puzzling problem child of the day before. It is because we did not solve the problem he presented, because we allowed him to remain unadjusted that we now deem it necessary to

provide severe penalties and harsh measures of repression including the habitual criminal statutes.

There are various opinions about causes of crime and numerous suggestions for punishing the offenders, but the one thing upon which there seems to be unanimity of agreement by all students of the problem is that criminal tendencies assert themselves very early in life, that youth is the time of lawlessness and that early recognition of the signs of delinquency and early corrective treatment should be more systematic and more scientific. It is not beyond our ability to discover and treat tendencies in school days. The neglected youth or the unsolved problem child is the genesis of crime. Considering the advances being made by educators, psychologists and psychiatrists in influencing human behavior it seems wise to provide for early examination of ability and aptitude so that our children may have the best possible adjustment to living in right relations with others.

EMPLOYMENT

The commission submits and recommends the enactment of a bill to regulate and stabilize employment and, so far as may be, to insure its steadiness and continuance.

In 1921 the legislature enacted a law, chapter 246, to provide for the extension of the public works of the state during periods of extraordinary unemployment caused by temporary industrial depression. It aimed to relieve unemployment by having the board of control expend the available emergency fund in extension of public work in manner calculated to furnish the maximum of public employment thus relieving distress. There is no doubt about the good intent of the measure or the good it might do if its provisions could be put into practice during the existence of a period of extraordinary unemployment. But such a period would pass before the machinery to make the investigation could get fairly started. Today the need is for measures to regularize and stabilize employment and insure its steadiness and continuance rather than relief for the distress caused by unemployment. We feel that regular employment has a stabilizing influence and provides insurance against crime; therefore we are proposing that it shall be the duty of the department of public works to ascertain and secure from the various departments, bureaus, boards and commissions of the state plans for such extension of the public works of the state as shall be best adapted to supply increased opportunities for advantageous public labor and to furnish regular and continuous employment to workers during periods and seasons of slackness in agricultural and industrial pursuits during temporary unemployment, and especially for the purpose of anticipating and so far as possible preventing any condition of extraordinary unemployment.

AID IN SECURING EMPLOYMENT

The commission submits and recommends the enactment of a bill amending the act of May 17, 1915, establishing free employment bureaus to extend further aid to those seeking employment.

We have a very excellent provision in law for free employment bureaus. They have accomplished an immense good, both to those

seeking work and those having work to offer. Located in the centers of population or in the midst of industrial and agricultural activity these bureaus are in position to know the present and anticipate the future labor requirements of the various sections of the state. They could do more effective work if they had the means for bringing the manless job and the jobless man together. We recommend that the Department of Industrial Relations, Division of Employment Bureaus, be empowered to make loans or advances for, and arrange for or to furnish transportation, tools, meals, board, lodgings and any other assistance necessary and proper for carrying out the object, spirit and purposes of the free employment bureau act, namely: to furnish employees to employers seeking help, and to assist persons desiring work to secure and continue in employment.

PROBATION

The commission submits and recommends the enactment of a bill amending section 1203 of the Penal Code relating to probation. It makes it the duty of the judge to refer to the probation officer all cases in which he desires to consider probation. The probation officer must make an investigation and file a written report as a record in the case. The judge must consider the report. If probation is denied a copy of the report shall be sent to the Board of Prison Directors.

One of the newer developments in the administration of criminal justice is the granting of probation by the trial judge in criminal cases. A similar procedure, particularly in the case of minor offenses, is known as "suspended sentence." In either event the procedure consists in suspending the sentence of a person convicted of crime and of releasing him upon certain terms and conditions, the violation of which may result in his being returned into court for sentencing in terms of fine or imprisonment. As is frequently the case, in the developing of new procedures, there have been many variations in the methods of various judges and other officers concerned in the probation process. There has also been widespread public criticism of the use or, as some people seem to think, abuse of probation and much bitterness of feeling has been engendered in the minds of police officials by reason of the methods in vogue in particular courts. The following may be listed as some of the objections to the present methods:

(1) Insufficient information upon the part of the judge as to the history, reputation and character of the convicted person. This results from lack of time or unwillingness to hear reports of arresting officers and to read and consider reports of probation officers. It involves also the lack of sufficient probation officers properly trained to make adequate reports for such purposes.

(2) Lack of uniformity of method of granting probation. This results from lack of similar training on the part of judges, tenderheartedness and sympathy for appeals made by effective pleaders as well as lack of understanding of the facts set out in (1) above. It is believed that an investigation will show that particular judges are much more lenient in granting probation than are other judges, and that attorneys engaged in the practice of criminal law are familiar

with this fact and try to have their applications for probation heard by judges who are known as more lenient than others.

(3) Influence alleged to be used upon judges, probation officers and others, to secure probation and to secure lack of supervision following the granting of probation.

(4) Improper facilities for care and supervision of persons on probation with the result that such persons are rarely brought back into court again unless and until they have committed other crimes.

(5) Confusion which has resulted from the new law permitting judges to sentence men convicted of felony to terms in the county jail as one of the terms of probation. The result is to further eliminate the difference between felonies and misdemeanors already practically impossible to distinguish; to complicate problems of administration in the county jails; and to change the theory upon which probation is granted, from one of leniency granted under conditions designed to rehabilitate the offender to one of reducing penalties of convicted felons and of avoiding the operation of the indeterminate sentence law and the power of parole exercised by the state board of prison directors.

The Crime Commission proposes legislation designed to change methods of procedure now in use in connection with the granting of probation so that in each case a report must be made by a probation officer following a careful investigation; consideration must be given to such report by the judge and the recommendations of the probation officer. Such a record will make possible a scientific study of the use of probation in felony cases and will provide a scientific basis upon which further legislation may be passed if it be needed to further remedy the existing situation.

AFFECTING PAROLE

The commission will recommend the enactment of a measure which will combine the Parole Act with the Indeterminate Sentence Law (1168 Penal Code), thus harmonizing certain seemingly inconsistent provisions of law and making other changes in existing sections of the Penal Code having to do with minimum terms of imprisonment and extending the powers of the State Board of Prison Directors with respect to parole.

REFORMATORY OR INTERMEDIATE PRISON FOR SEGREGATION OF YOUNG FIRST OFFENDERS

The commission submits and recommends the enactment of a bill providing for the construction of an intermediate prison for first offenders between the ages of eighteen and twenty-four years.

The question of the establishment of a penal institution for first offenders is not a new one in the State of California. Some twenty years ago Governor Young sponsored such a bill, and, in fact, land was provided for the purpose of carrying into effect the provisions of the law. Certain conditions obtained which made it necessary to change the plans provided for the establishment of such an institution, and since that time nothing more has been done looking toward the establishment of such a prison. Of late there has been much agitation for the establishment of a penal institution midway between the

reform school and the state prison to which might be committed persons who, on account of their age or the nature of the act itself, might not be fit inmates for a reform school, yet not sufficiently hardened to be incarcerated in a state prison.

The commission has given the establishment of such an institution much consideration. Scores of letters were sent to lawyers, penologists, editors, publicists, social workers, officials, and others relative to the establishment of such an institution, and there has been an almost universal response that the demand for such an institution is now most apparent.

At the present time the reform schools and state prisons are crowded to overflowing. There is much agitation for the establishment of another state prison. There is abundant record to show that many criminals of the present fall in the years from 18 to 24. Many of these persons have committed more than one serious offense, and the question of dealing with them has become acute and at the same time perplexing.

The nature of the institution itself is one which has given rise to much discussion. In our opinion persons should be committed to this institution who are not over 24 years of age. Persons over this age have certainly secured to themselves that degree of discretion which should impose upon them the necessity of right living. It also seems that the age limit, so far as a minimum is concerned, should be fixed at 18 years.

The commitment of all first offenders to this institution would not necessarily indicate that they should be kept there indefinitely. It is the opinion of your commission that the rules and regulations incident to the government of this institution should be flexible enough to admit of the transfer of persons originally committed to this institution to one of the state's prisons whenever in the opinion of the governing board of the institution the person in question becomes incorrigible, or otherwise not amenable to discipline, and when the best interests of the institution and the inmates generally might make such transfer imperative.

It is also the opinion of this commission that the court should be vested with authority to commit to a state prison any individual convicted of an offense coming within the age limits of 18 to 24, even though a first offender, when in the opinion of the court the person in question is so hardened and abandoned as not to be fit for incarceration in this institution. We feel in this way that the institution would be kept as an institution for first offenders, or for those who seem susceptible of reformation.

The government of such an institution, as heretofore indicated, should be in the control of the State Board of Prison Directors.

It is imperative that every opportunity should be provided within the institution for vocational and industrial training for each person incarcerated therein, and each inmate should be required to perform a certain task, and in addition undertake to learn some trade or vocation which would provide him with the means of earning a livelihood when released. The merit system should also be instituted, and credit should be given in accordance with the schedule now in effect in our state prisons. The salutory provisions of the parole system

should also be provided for this institution. When the inmates are released upon parole they should be subject to the same strict conditions which obtain with respect to prisoners who are released from San Quentin and Folsom. We feel that this work could be adequately assumed by the parole officer, although it is necessary that additional help be afforded him for the duties which would attend the supervision of the persons released from this institution.

In our opinion the following benefits would accrue from such an institution:

1. Young and impressionable first offenders would be segregated from older offenders many of them repeaters.

2. Persons would be punished who might otherwise be released on probation, rather than sent to state prison, as so often obtains at the present time.

3. The inmates of this institution, including persons coming within a certain designated class, of like age, would be more amenable to discipline, and would have impressed upon themselves an object lesson the salutary effect of which can not be denied.

4. By reason of the fact that the inmates of such an institution would include a selected group of individuals, so to speak, not hardened in crime, opportunity to provide them with vocational and industrial training would be practicable.

5. This institution would play an important part in the elimination of the recidivist by reason of the selective methods employed, the segregation practiced, and the opportunity afforded to learn some honorable and useful vocation or trade to be practiced by the inmate upon his discharge.

Inasmuch as more facilities must be provided, we feel that the additional institution here recommended would be best adapted to relieve present overcrowded conditions at San Quentin. By instituting the reformatory plan, there is offered the hope of weaning young first offenders away from lives of crime.

PROVISION FOR PRODUCTIVE PRISON LABOR

The commission submits and recommends the enactment of a bill providing for productive activities of prisoners at state prisons and reformatories, providing for payments and credits for such work, defining the powers and duties of the state board of prison directors in respect thereto and prescribing certain penalties and forfeitures.

This bill is designed to expand the industrial activities of the state prisons, to require prisoners to earn their support while in prison, and to give them opportunity to share in the proceeds of their productive labor above the cost of their support, under rules and regulations to be established by the prison directors.

It is the intention of this measure to provide labor and to require and compel able-bodied prisoners to work for their support and to afford them opportunity to earn by diligent labor while in prison so that if a prisoner is capable and works hard he may have the means to support himself, when he is discharged from prison, until he can obtain employment.

It also provides that a prisoner capable of earning by his labor while in prison may pay a percentage of what he earns to his dependents so that those dependent upon any prisoner shall not be left in want by reason of his commitment for crime.

At the present time convicts leaving the prison are supplied with clothing, the amount of money necessary to pay transportation to the place from which sentenced, and five dollars additional. The purpose of the law now proposed and here referred to is to provide incentive to the prisoners to do more and better work and develop in themselves habits of industry and skill as well as disposition and determination to earn their living, and as such habits are inculcated in prisoners they may be weaned away from criminal tendencies.

It is not expected that prisoners would be able to earn very much under this plan, at any rate not in the beginning, for necessarily the Prison Directors would start slowly and develop the plan gradually. But it provides a sensible, practical plan for prisoners to show whether or not they are capable of supporting themselves when the opportunity to earn is offered.

STATE BUREAU OF CRIMINAL IDENTIFICATION AND INVESTIGATION

The commission submits and recommends the enactment of a bill amending the act creating the State Bureau of Criminal Identification and Investigation. The bill provides for the appointment by the board of managers of special investigators to assist peace officers throughout the state in detecting and apprehending criminals. It also requires the bureau to compile, and certain state officers to furnish, statistics on crime. It is made the duty of the Bureau to arrange for police schools.

The California State Bureau of Criminal Identification and Investigation was reorganized by legislative act in 1917. It has continued ever since without material change in the character of its work or the number of its personnel. In view of the relatively small budget under which the bureau has been operating the result of its efforts is highly creditable.

The time is ripe for the further expansion and usefulness of this bureau. There are several functions which it could perform with great advantage to the state. The Commission recommends three additional functions to be performed by this bureau, which are as follows:

1. Attaching several specialists in crime detection to the bureau and making them available, upon request, to peace officers throughout the state to assist in the apprehension of criminals.
2. Arranging for police schools.
3. Requiring the appointment of a competent statistician whose duty it will be to gather and compile information and statistics of crime and making it the duty of certain officers to furnish information and statistics on standard forms.

Special Investigators. The commission has inquired of many peace officers in California as to the usefulness of special investigators or detectives who might be available to them or to other peace officers throughout the state upon request made to the Bureau of Criminal

Identification. In each instance the response has been favorable and enthusiastic. Peace officers in rural districts, because of the lack of experienced training and limited funds, would gladly call upon the bureau for such assistance. Most of the larger municipal centers have well organized police departments. They have men detailed to investigate complaints and apprehend criminals along specialized lines. This method, however, can not be practiced in rural communities. Such men as August Vollmer, chief of police of Berkeley; Duncan Matheson, captain of detectives of San Francisco, and Donald Marshall, chief of police of Oakland, have stated that a few competent investigators attached to the bureau would be of material benefit in the apprehension of criminals, particularly gangsters, robbers and bandits who move about from place to place throughout the state. Clarence S. Morrill, superintendent of the Bureau of Criminal Identification and Investigation, made the following comment to the commission relative to such investigators:

> "The identification bureau should be extended to a point where specialists could be employed who would be sent from the bureau to various counties. In order to do this work properly it would require about six men—two men would be required for homicide cases, one man for bad check cases, one man for burglary cases, one man for robbery cases and one man for stolen automobile cases."

The board of managers of the bureau in their report to the Governor dated August 30, 1928, said:

> "We are of the opinion that the arm of the law may be considerably strengthened by attaching to the bureau a Section of Investigation, this section to consist of professionally trained criminal investigators who would confine their efforts entirely to the investigation of major crimes committed in the state. These investigators would assist municipalities and counties when called upon by officials and would also take up the pursuit of habitual criminals known to be operating in the state. In this connection, it should be noted that investigators of this character would not be used for the investigation of minor crimes, but only for major crimes or the activities of habitual criminals."

The commission has been informed that peace officers in smaller communities and in rural districts often call upon police departments of large cities for men who have made a specialty of apprehending certain types of criminals. This practice is not carried on to a large degree because the rural peace officers have not sufficient funds available with which to pay the expenses of men so furnished to them by the larger cities. With a few well trained detectives attached to the bureau they could be sent to the various parts of the state without expense to the local or rural communities. Rural peace officers would eagerly avail themselves of this opportunity. These investigators could also act as an effective means of cooperation and coordination among all the peace officers of the state, particularly in the solution of serious crimes which have a statewide aspect.

In this connection it should also be remembered that California has made tremendous strides in industrial and economic development. It has highways connecting all the centers of population and interlacing every part of the state. Second to New York it has more automobiles than any other state in the Union. The criminal today may commit a crime in one part of the state and in a few hours be hundreds of miles

away. Local police officers are handicapped by being more or less confined in their operations within their several jurisdictions. A criminal is not confined by city, township or county boundary lines. A small number of experienced, competent and serious-minded investigators attached to the Bureau of Criminal Identification would perform excellent service toward apprehending felons who move about throughout the state.

Police Schools. It is an accepted fact that peace officers, in the main, are not properly trained for their work. There are many reasons for this. Sheriffs and constables are elected every four years. Men without any experience whatever are continually being elected to these offices. After election, deputies in these offices are changed to meet political obligations. In counties having charters and municipalities, the change in the rank and file of officers is not so frequent. Chiefs of police in large cities are often removed as the result of changing political conditions. Peace officers holding positions under civil service feel secure in their positions and are not enthusiastic about police schools and additional training. The difficulty experienced by police departments in this respect is will demonstrated by the remarks of James E. Davis, chief of police of Los Angeles:

> "Schools for the instruction of police have been instituted from time to time in the Los Angeles Police Department. The schools have met with mediocre success due to lack of funds and interest on the part of the police. It seems that older police object to instruction, particularly if they have to attend classes on their own time."

Another difficulty is the lack of instruction in police work in our state university and our public schools. Except in such schools as are instituted by police departments in the larger cities, with entirely inadequate time and funds, there is no agency in California where a police officer can obtain training. These officers gain their knowledge of criminal law, methods of crime detection and the rights and duties of peace officers almost entirely from experience.

Bruce Smith, in his report on Rural Police Protection in Illinois, prepared by the Illinois Association of Criminal Justice in May, 1928, in speaking of police training, said:

> "No lesson of American or foreign police administration could be more clear than that the making of the policeman has only begun when he receives his warrant of appointment. The training which he must receive must be both of a theoretical and a practical nature. An intensive training course for the recruit should include study of the penal laws and of the statutes controlling criminal procedure; the use of police weapons; self-defense; the rules and regulations of the police force; the extent and limitations of the policeman's powers and his relationship to the public. These do not in themselves qualify the recruit for police duties, but if he has been rigorously drilled in their meaning and importance, he may be placed on patrol with a larger degree of confidence than is now possible."

The commission is of the opinion that the state, as an active governmental unit, should play a greater part in helping to limit crime in California. Crime is no longer a local concern. It is statewide in scope. The state should not longer ignore this problem and expect it to be solved by the police and law-enforcing agencies in hundreds of local towns, cities, townships and counties, all operating independently

of each other without a central coordinating agency. The proper state agency to coordinate local law-enforcing agencies is the Bureau of Criminal Identification and Investigation. Schools for the training of police officers by this bureau could be held from time to time in various parts of the state. They would be of material aid in the training of more efficient police officers. It would likewise be of great assistance in coordinating and centralizing police work throughout the state.

Criminal Statistics. Canada, a government to which our attention is frequently directed, as an example of efficiency in law enforcement, maintains an excellent criminal statistical department. On September 30, 1925, the forty-ninth annual report of criminal statistics, containing 365 pages, was published by the Dominion Bureau of Statistics. This report contains figures collected from 155 criminal jurisdictions and from penal institutions, police forces and other miscellaneous sources.

This commission had hoped to gather some figures showing crime conditions in California. It was soon found that there were very few figures available and that those that were available in various police departments of the state were at such variance with each other that they were practically useless. Figures were sought to show the number of arrests as compared with crimes known to have been committed. If these figures could have been obtained, they would indicate two things: First, the number of crimes in proportion to population; and, second, the efficiency of law-enforcing agencies.

To contrast the lack of information in California on this subject, attention is directed to the following figures taken from the Canadian report (page xxii). In 135 cities in Canada, each with a population of over four thousand, and a total population of 3,317,450, it is shown that the number of offenses known to the police to have been committed was 215,034, with arrests and summons issued to the extent of 182,228. The number of prosecutions resulting was 178,579, from which 129,022 convictions were secured. With accurate figures of this kind from 135 cities, compiled to show the comparison of one city with another, it is easy for the Canadian authorities to pick out the weak spots in law enforcement.

Much printed space has been devoted to the subject of criminal statistics. Much talk has been indulged. Very little, however, has been accomplished in the United States. We quote from a few selected authorities. From the report submitted to the National Crime Commission by the subcommittee on pardons, parole, probation, penal laws and institutional correction, headed by Hon. Frank O. Lowden, on the subject of "Criminal Statistics and Identification of Criminals," the following is taken (pages 8 and 9):

> "How is it with this great organization which we call criminal justice made up of police, courts, prisons, parole and probation officers, and doing a business that runs into millions and millions of dollars in each state of the Union? What do we, the owners, know about the operation of these various units? Almost nothing. The United States has the worst criminal statistics of any civilized country in the world and has the most crime. Is there any connection between these two facts? It seems to us that the connection is clear. Without detailed facts and figures showing exactly what is going on, we, the owners, can not exercise any effective control over the individual units engaged in the work of suppressing crime. We may no longer depend

on what we as individuals know about affairs; the business has grown beyond our personal knowledge.

An absolute essential in the building of a good police force is the matter of reports. No modern business concern would dream of carrying on for even a day without having a complete system of recording its work; and yet few police forces in this country keep records that would even remotely compare with those of the average business house. It would seem, as the first principle in efficiency, that the head of every police force should have laid before him daily a summary of crime conditions in the city, and that at the end of the year he should make a complete public report, not merely of the arrests but of the complaints as well. How can we the public, judge the efficiency of a police force in eliminating crime if we have no records that will make possible a comparison of complaints with arrests, that is, of the amount of work to be done by the police with that accomplished? For the most part, the annual police reports are little less than ridiculous. Information as to the number of sick horses, bushels of oats for the horses, pairs of puttees bought, days of illness, number of guns, and sometimes the number of arrests, can be had, but it is useless to look for a statement as to the number of crimes reported or any facts that would enable one to judge the efficiency of the force. How can the men be assigned to the various districts of a city if constant watch is not kept on the varying criminality in each district? The lack of adequate statistical information bearing on the activities of the police in the suppression of crime is certainly one good explanation of the prevalence of crime in American cities."

Observations on this subject by the New York Crime Commission accurately express our views. We quote from their report of 1927 (pages 47–48):

"It is to be hoped that New York will take the enviable position and lead America in producing a publication of statistics that will rank with the superb documents which come to use each year from the Dominion of Canada and from England, publications that are models of their kind—literally the last word on the subject. It would certainly seem as if the time had come when the publication of 17 different reports dealing with the statistics of crime by 17 different official agencies within one city in the state should come to an end, and that one complete presentation of at least the statistics of crime should be had in future, instead of 17 conflicting ones that are at variance with each other and which do not even tally as to the volume of work undertaken."

The New York legislature in 1928 enacted a statute requiring the Division of Criminal Identification of the Department of Correction, to gather, compile and publish crime statistics and making it the duty of law-enforcing officers to furnish appropriate data (chapter 875, N. Y. Laws 1928).

The most complete statistics available in California are those compiled by the Attorney General, Board of Prison Directors and the Police Department of Los Angeles. Since 1900 the Attorney General has made biennial reports showing the number of felony prosecutions in the superior court and the disposition thereof, also a complete record of cases appealed to the higher courts. The Board of Prison Directors has for many years published a biennial report showing the prison population of San Quentin and Folsom, and other valuable data relative to the inmates and the offenses for which they are incarcerated. The Police Department of Los Angeles publishes annually a splendid report of crimes reported, arrests made, disposition of offenders after arrest, together with many tables and charts setting forth data such as age, sex, birthplace and nativity of offenders, and the amount of prop-

erty stolen and recovered. Much valuable information can be obtained from the reports published by these governmental departments.

Many reports are published by police departments in this state. To a large extent they are filled with lists of police personnel, data regarding traffic violations, history of the department, names of retired officers, pension lists, relief associations, departmental budgets and matters of purely local concern. Very little space is devoted to the classification and number of crimes committed, arrests made, number of convictions, offenders held to answer, disposition of cases, causes and extent of crime, methods of prevention, police schools, or such kindred subjects as would be valuable for the study of crime conditions. Such reports as are published are compiled according to the idea of the commanding officer of the various police departments. Each differs from the other. They are valueless as a basis for the study of crime in a state-wide sense. The same holds true of reports compiled by probation officers, sheriffs and coroners.

The commission is strongly in favor of the establishing of a section within the State Bureau of Criminal Identification and Investigation devoted to the extention of its present work of gathering information which will enable the Governor, his cabinet and the legislature to know something about crime conditions in this state. It is a task which the state should assume.

CONTROLLING FIREARMS

The commission submits and recommends the enactment of a bill amending the act of 1923, regulating the possession, sale and use of pistols, revolvers and other firearms capable of being concealed upon the person. The bill requires all persons desiring to purchase a firearm capable of concealment to file an application to carry such weapon. Such application shall contain information regarding applicant, including his finger prints. Copies of all applications and dealers registers must be mailed to the State Bureau of Criminal Identification and Investigation to be checked.

In a very large percentage of the serious crimes now being committed, a firearm of some sort is used. Robberies and burglaries are almost invariably committed with the aid of pistols. Guns are frequently used in murders, manslaughters, highjacking and rum-running cases. The pistol came into its own, as an effective weapon of the criminal, when the present day automobile made the fast getaway possible. Automobiles are being used not only as a means of escape but as a place from which shots are fired.

The sale of automobiles can not be regulated to keep them out of the hands of criminals, but the sale of firearms can be regulated and effectively controlled. Pistols are acquired by criminals in two ways; by purchase or by theft. The purchase of firearms by undesirable persons should be prevented as far as is humanly possible. The Baumes Committee of New York in 1926 made the following observations relative to firearms:

> "It is unquestionably true that the pistol is one of the greatest, if not the greatest, menaces to the peace of society today, and that its free use in the commission of crimes of violence has caused more unrest among people, and added more to the horror of crimes than any other one thing. It is one reason why crimes of violence are common today and the criminal successful

in such crimes, particularly holdups and robberies. Add to this the use of the automobile for quick getaway and you have a complete picture of the terror which is spread among people and of a situation which puzzles the police to detect or prevent, and the courts to punish.

While New York state was a pioneer in seeking to control the use of pistols, there is still the necessity for some means to be found by which the consequence of the use of pistols by criminals can be made so dreaded that they will be deterred from using them. It is stated by a prominent authority that there are more people shot to death in the United States by pistols than in all the rest of the world.

The government officials charged with the responsibility for the enforcement of criminal laws are of the opinion that the control of the pistol is of fundamental importance. Three international police conventions, representing forty-seven nations of the world have, by formal resolution, expressed this view."

(Report of the Crime Commission of New York state, 1926, pages 14-15.)

In 1927 the Crime Commission of New York state, in its report, said:

"Firearms in private homes cause many tragedies and are of little avail for defense against criminals. The argument that a revolver in a man's pocket is a protection, is a fallacy. He is safer without a gun than with one. The ordinary citizen walking along the street, even though he has a gun in his hip pocket, if suddenly called upon to "stick-em-up" and feels a pistol stuck into his ribs, is likely to comply with such a demand, that is if he is an intelligent person, for the crook can always beat him to it in the use of a gun. Similarly a householder confronting an armed burglar who has invaded his home at night seldom has opportunity to get his gun from where it is kept and defend himself. Here again the crook "beats him to it."

Some persons take the view that there is no use in any of the states enacting pistol laws and that nothing can be done until the federal government controls pistols. It is also held that there is no use in the state of New York enacting an effective pistol law so long as a man can cross into New Jersey and get all the pistols he wants or can go to Connecticut or to some other neighboring state and get them there, or send an order to a mail order house and get a pistol through the mails.

This is a partial and short-sighted view of the situation. In the first place it is probable that the federal government can never control the sale and use of pistols in the various states, for that power has not been delegated to it by the states. Probably all that the federal government can do is to prohibit the transportation of pistols in the mails, the importation of pistols into the country from outside and the transportation of pistols from one state into another state, where that state has laws forbidding or controlling the sale of pistols.

The recent enactment by congress of a law forbidding the transportation of pistols in the mails should go far to stop the mail order business in pistols, but all a person needs to do to get a gun, even with this new enactment, is to have his pistol sent by express; and dealers in pistols who have made large sums of money in this profitable trade are not likely to cease that trade because of this change in the statute. It was entirely proper to have such a law enacted, however, for the government should not even have the semblance of being a participant in crime.

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We have no patience with the parrot-like cry that no law can be enacted which will keep guns out of the hands of crooks. This may be true and may not be true. If such an argument were taken seriously it would apply to all legislation. It would be just as wise to say that there is no use in enacting a law against the sale and use of dangerous narcotic drugs, for it will never be possible to completely keep these out of the hands of persons who wish to peddle them, or to use them, and the analogy might be extended further but a discussion of the subject in that aspect is profitless. There is no doubt that the Sullivan law, inadequate as it is, has proved a most effective weapon in enabling the police to deal with crime and criminals. What is needed now is to strengthen that law to meet modern conditions."

(Report of the Crime Commission of New York state, 1927, pages 16-17.)

Clarence S. Morrill, superintendent of the Bureau of Criminal Identification and Investigation of the State of California, made the following comment to the commission:

> "The report of the sale of firearms by dealers should be sent to the State Bureau of Criminal Identification rather than to the county clerk. It would be a good idea to require the purchaser of a firearm to have a permit before he makes the purchase. It would likewise be helpful to cause the purchaser of a firearm to have his fingers printed."

Court Smith, warden of Folsom Prison, at a meeting of the commission in Sacramento, said:

> "A chief of police in one part of the state should not be permitted to grant a permit to a person residing in another part of the state to carry a firearm. If a person moves to another part of the state after getting a permit, he should be required to get a new permit at the place where he carries the gun. Criminals often get guns from stolen automobiles or they steal them from homes. Many dealers do not report sales of guns. The same situation applies to the Motor Vehicle Act requiring garage owners to report storage of cars. A similar situation prevails oftentimes with respect to pawnshops. They frequently fail to make reports to officials."

T. N. Koening, chief of police of Sacramento, at a meeting in Sacramento, in speaking of the firearms situation, said:

> "Often when applications are made to me for permission to carry a gun I advise the applicants to buy a police whistle; blowing a police whistle is more protection to the citizen than a gun. The twenty-four-hour notice by the dealer to the police is too short to permit the police to make a proper check of the applicant. The time should be lengthened to forty-eight hours. Finger printing of applicants would assist the police in making a check. I believe the gun law has had the effect of cutting down the sale of firearms. The gun law does not regulate the sale of guns by persons other than the regular dealers.

Chester Rowell of Berkeley has the following to say regarding the use of firearms:

> "Watch the news on this subject, as the writer has done for years, and this is the sort of thing you will always find. In the past thirty years, so far as memory recalls, there have been just two instances in the news in which the weapon kept for protection killed the right person, and in one of these two it was a shotgun. In neither of them was the householder any safer than he would have been if unarmed. But there are literally hundreds of cases in which the weapon, kept supposedly for protection, killed the owner or one of his family. There are dozens in which the burglar was captured and hundreds in which he was frightened away without weapons, and there are not a few in which armed men were shot by burglars or robbers who would not have been hurt if unarmed."

After careful thought the commission will offer to the legislature for consideration a bill, which will amend the present firearms law. The commission recognized that the present gun law of this state is an excellent law and has been of material aid in curbing the unrestrained sale of guns. The amendment to the law is offered solely with the thought of strengthening the statute.

The amendments to the act will make the following changes:

1. Every person who desires the privilege of carrying a pistol (defined in the act as a gun with a barrel less than twelve inches in length) must first apply to the proper peace officer in his community for a permit to carry such weapon. The application shall be in duplicate and shall, in addition to the data now required by the statute,

contain the fingerprints of the applicant. A copy of the application shall be mailed to the Bureau of Criminal Identification and Investigation at Sacramento by the peace officer on the day the application is made. It becomes a misdemeanor for any person to give false information in the application.

2. Every person desiring to purchase a pistol or revolver, after procuring a permit to carry such weapon, must present his permit to the merchant, or other person from whom he desires to make the purchase. If the purchase is to be made from a merchant he must sign a register in triplicate. The register, in addition to the data now required by statute, shall set forth the date of the permit and the name of the officer who issued the permit. On the date of sale a triplicate copy of the register sheet will be mailed to the Bureau of Criminal Identification at Sacramento and another to the officer who issued the permit. No revolver shall be delivered to the purchaser until seventy-two hours after the copies of the register are mailed.

3. If the superintendent of the Bureau of Criminal Identification finds that the record of a person making application for a permit to carry a concealed weapon is such that the permit should be refused, he shall so advise the officer to whom the application is made. Upon receipt of such notice from the bureau, it shall be the duty of the officer to deny the application. The Bureau of Criminal Identification is also given the power to prevent the delivery of a pistol to the purchaser if the record of the said person is such that it seems advisable to refuse such purchase.

RECEIVERS OF STOLEN PROPERTY

The commission submits and recommends the enactment of a bill adding a new section to the Penal Code to be numbered 496c providing that any person receiving stolen property without making diligent inquiry to ascertain that the person selling the property has a legal right to do so, is guilty of a felony. The burden is placed on the defendant to prove that he made such diligent inquiry.

The receiver of stolen property, commonly called "the fence," is frequently a professional criminal. He encourages others to rob, steal and burglarize. He thrives on the crimes of others. Often his outward appearance is that of a good citizen conducting a legitimate business. Under this guise he carries on his nefarious trade.

It has been reliably estimated that ninety per cent of stolen property is not recovered. What becomes of this ninety per cent? The thief who steals it has no use for it unless he can convert it into cash. In order to get cash he must sell it to someone with whom he is in league. One fence may deal with a dozen thieves and be the inducing cause of hundreds of thefts, burglaries and robberies.

It has frequently been brought to the attention of this commission by judges and law enforcing officers in Los Angeles County that young men come to that county from eastern states without adequate means to sustain themselves. They visit pool halls and other hangouts and are advised that a good way to get money is to steal and sell the loot. They are told where they can sell stolen property. Men engaged in the business of dealing in stolen property buy the goods and provide them with money.

Fences are difficult to convict. This is forceably shown by the following figures taken from the United States Census bulletin on prisoners in 1923.

Persons in prison in the United States for having stolen property, January 1, 1928	1248	
Burglars		16,580
Larcenists		17,462
Robbers		9,269
Totals	1248	43,311

Also from the following figures taken from the biennial report of the State Board of Prison Directors for 1925-1926:

Prisoners received at San Quentin from July 1, 1925, to June 30, 1926, for following crimes:		
Receiving stolen property	35	
Burglary and attempted burglary		471
Larceny		191
Robbery		222
Totals	35	864

The receiver of stolen property is difficult to convict. This is so for two reasons, first, because it is difficult to obtain evidence. The fence deals with persons who are themselves criminals. Their transactions are carried on under cover. Neither will give information about the other. Secondly, because the laws are such as to make conviction difficult. In many states the law makes the thief an accomplice of the receiver. Neither can be convicted on the uncorroborated testimony of the other. It can be readily seen how nigh impossible it is to obtain corroborating testimony of a transaction between two criminals. In California, however, the accomplice statute does not apply to the fence. This statute, section 1111, Penal Code, reads as follows:

> "A conviction can not be had upon the testimony of an accomplice unless it be corroborated by such other evidence as shall tend to connect the defendant with the commission of the offense; and the corroboration is not sufficient if it merely shows the commission of the offense or the circumstances thereof. An accomplice is hereby defined as one who is liable to prosecution for the identical offense charged against the defendant on trial in the cause in which the testimony of the accomplice is given."

The thief, under our definition of an accomplice, is not an accomplice of the receiver. He can not be prosecuted for the identical offense. The offense of the person who steals the property is theft (section 484, Penal Code). The crime of the fence is receiving stolen property (sections 496, 496*a* and 496*b*, Penal Code). The case *In re Morton*, 179 Cal. 510, holds that a receiver of stolen property is not the accomplice of the thief. California has been saved the necessity of amending its accomplice statute to cure the difficulty which exists in many states of the Union. This year the New York legislature changed the law in that state (chapter 170, Laws of New York 1928) by declaring that the thief is not the accomplice of the receiver of his stolen goods.

An obstacle to procuring convictions in these cases still remains. Under the law in California, as it now stands, the burden of proving that the receiver knew he purchased stolen property is on the people.

It is almost impossible to prove what a man knew or did not know, especially a sharp criminal who is careful to have it appear that he did not know he purchased stolen goods.

To meet this difficulty the New York Crime Commission recommended, and the legislature of that state in 1928 passed, a law which placed the burden of proof on the person who has stolen property in his possession to prove that he made diligent inquiry to ascertain whether or not the goods were stolen (chapter 354, Laws of New York, 1928). The National Crime Commission is now sponsoring a similar bill pending before congress.

This commission recommends the enactment of a law along similar lines. The proposed bill provides that any person who receives stolen property without making diligent inquiry to ascertain that the person selling the property has a legal right to do so, is guilty of a felony. It provides further that any person who fails to make diligent inquiry before receiving stolen property is presumed to have taken it with knowledge that it had been stolen. This presumption can be rebutted by proof. It also provides that if it appears from the evidence that the defendant has stolen property in his possession, the burden shall be upon him to show that he made diligent inquiry to ascertain that the person from whom he received it had a legal right to deliver it to him.

INSTRUCTIONS TO JURIES

The commission submits and recommends the enactment of three bills adding new sections to the Penal Code, to be numbered sections 1127a, 1127b, and 1127c, standardizing instructions to juries on the subjects of indirect evidence, expert witnesses and flight.

The attention of the Crime Commission has been called to the advantages which would accrue by way of simplification of jury trials if a few widely used instructions in criminal cases were simplified and standardized. Honorable James G. Conlan, judge of the superior court of the city and county of San Francisco, and Professor J. P. McBaine, Dean of the Missouri Law School and a member of the Missouri Crime Commission, stated to the commission that in their opinion standardization of certain instructions would work toward simplification of jury trials and aid in cutting down the number of reversals on appeal.

Justice Baldwin, as early as 1861 in the case of *People* vs. *Gibson*, 17 Cal. 283, advised the use of simple instructions. He said:

> "We suggest that it is better, as a general rule, for the judges to instruct the jury in capital cases, in only a few plain principles of law, when charges are not asked by counsel. A long complicated charge, extending over many pages of paper, is calculated rather to confuse than enlighten them as to the law, and besides furnishes matter from which appeals may be taken, and not unfrequently with success, when on the whole case the verdict was right."

The first step in this direction was taken in 1927 when the legislature added section 1096*a* to the Penal Code. This section standardized the instruction on reasonable doubt. In speaking of this section, Professor C. G. Vernier of Stanford University, and Philip Selig, Jr., in their article recently published in 2 Southern California Law Review, said:

"Fortunately in 1927, Penal Code section 1096 was amended to give a statutory definition of reasonable doubt, and it was provided in a new section (1096a) that the trial court may read the statutory definition, which will be deemed sufficient without further explanation or comment."

Faulty instructions have been the cause of many reversals on appeal. Each judge instructs the jury on the law as he interprets it. Sometimes a misstatement of the law is made which results in a reversal by a higher court. The commission has considered the advisability of defining a few principles of law in simple language. The proposed sections direct the court to give instructions on the subjects defined in the language of the code. The definitions and instructions recommended cover the subjects of "expert witnesses," "flight" and "circumstantial evidence."

OBJECTIONS TO INSTRUCTIONS

The commission submits and recommends the enactment of a bill to provide that error in instructing the jury is not to be ground for new trial or reversal on appeal, unless the error shall be specifically called to the court's attention before the jury retires to deliberate and that when so called to the court's attention the judge may correct the error.

The manifest unfairness of permitting astute and technical counsel to sit dumb while a judge commits an error in instructing a jury and to first raise the point on appeal when there is no chance to make the correction is so clear as to need no argument for its condemnation. The practice in the federal courts is to object to the instructions when given and to specifically point out the error and the reason for the objection. The enactment of this section is proposed by the commission with the purpose of simplifying the trial of criminal cases and minimizing the number of errors committed by trial judges and with the hope that it will correspondingly decrease the work of the appellate and supreme courts.

Trial judges are compelled to draft instructions in more or less haste. It is a matter of common observation that the judge is usually forced to prepare his instructions during the argument of counsel, and not knowing until the last minute what evidence may develop, he can hardly prepare his instructions fully until all the evidence is in. The liability of error, due to slips of the pen or of the tongue, and the common forgetfulness to which we are all subject, causes error to frequently creep into the instructions.

The elation of defending counsel at such mistakes on the part of the court has been noticed by every lawyer and every judge who has frequented criminal trials. There is no hardship in insisting that counsel shall call the court's attention to its mistakes opportunely so that he may correct the mistake, as is done in the federal courts.

COMPROMISE OF CRIMINAL CASES

The commission submits and recommends the enactment of a bill amending sections 1377, 1378 and 1379 of the Penal Code relating to the compromise of criminal cases.

In a recent number of the Los Angeles *Times* there appeared three articles, each indicating the importance of the subject of the compromise of criminal cases. One was an article relating to the activities of

the grand jury in indicting the district attorney of Los Angeles County on account of alleged criminal adjustments of criminal cases which had come into his office in his official capacity as state prosecutor for the county of Los Angeles.

The second article referred to the activities of the State Bar in proposing to take to the State Supreme Court the action of a superior judge in accepting a check for $2,500 from Angeles Temple at about the time when certain criminal cases then pending against Aimee Semple McPherson were dismissed without prosecution.

The third article had to do with the action of the State Bar in disbarring two Los Angeles attorneys because of their activities in procuring the settlement of certain criminal cases and for appropriating to their own use, money which had been deposited as bail on behalf of their clients.

A method of procedure which makes possible such a condition is certainly in need of revision. One of two things is certain in each of the three cases referred to. Either a gross abuse of power has taken place upon the part of each of the three important agencies constituting the officers of the court charged with the administration of justice, namely, the judge, the prosecuting attorney and the defense attorneys; or on the other hand, representatives of each of the three groups are now being subjected to unjustified attack and abuse because they are not properly protected under the present procedure. There is no escaping the fact that the present methods of procedure followed in the compromise of criminal cases make possible the abuse of power by such officials when they are disposed to act in such manner and also that such procedures subject honest, law-abiding officials to unjust attack and abuse in particular cases. Similar cases from other counties are coming up with increasing frequency.

Few people realize the extent to which criminal cases are adjusted or compromised without trial. Much attention has been given by those who are interested in reforming the administration of criminal justice, to changing the trial process. We have heard much of the necessity of reforming our jury system. Volumes have been written upon the subject of the insanity defense. Much has been said about procedure upon appeal in criminal cases. As a matter of fact, a large percentage of criminal cases are disposed of before they ever reach the trial process and many of them are never presented to juries at all. Attention must be directed to that comparatively unsupervised field of procedure which precedes trial and during which the adjustment or the compromise of criminal cases is not only possible, but widely practiced. The Crime Commission proposes legislation which is designed to bring such matters into the open, requiring that a record be made in each case showing the considerations leading to a settlement and making possible an investigation of the conditions under which the settlement was made. Then, at least, an intelligent study can be made of the compromising of criminal cases and if further steps are necessary, to correct the present situation, it will be possible to provide a scientific basis upon which such changes may be made.

REPORT OF INJURIES

The commission submits and recommends the enactment of a bill requiring hospitals, pharmacists and physicians to report to certain peace officers information concerning persons coming to their attention suffering from traumatic injuries.

There is no state law in California requiring owners of hospitals, physicians, pharmacists and nurses to report to police officers cases coming to their attention of persons suffering from gunshot and knife wounds, or other injuries self-inflicted or inflicted by others. It is important that such cases, with a few pertinent facts relating thereto, be promptly reported to the proper police authorities. Peace officers are called upon to use great effort and ingenuity to identify and apprehend modern criminals. Those groups of our citizens who come in contact with individuals who are parties to crimes, or who have knowledge of the surrounding circumstances, should assist in the task of ferreting out criminals by making known to police authorities facts which indicate that a crime has been committed.

Los Angeles, San Francisco and Oakland have ordinances along identical lines. There are numerous hospitals and persons outside of municipal limits, where such ordinances do not exist, who come in contact with persons suffering from traumatic injuries. The commission recommends that a statute be enacted to incorporate the views here expressed and making the failure to render a report a misdemeanor.

SOLICITATION TO COMMIT CRIME

The commision submits and recommends the enactment of a statute making it a felony to solicit another to commit a felony.

At present an offer to accept a bribe and a solicitation which culminates in a conspiracy or in some overt act consummating the agreement are the only solicitations which are in themselves criminal.

Professor Vernier suggested the adoption of a statute which will conform to the law of other states and countries by denouncing the solicitation to commit felonies. As a safeguard of the rights of innocent persons who might be accused of making such solicitations the commission has thought proper to provide that the evidence by which the crime must be proved shall be the testimony of two witnesses or of one witness and corroborating circumstances. The commission feels that enactment of this statute will deter evil disposed persons from soliciting others to join in the commission of felonies.

BAIL IN FELONY CASES

The commission submits and recommends the enactment of three bills relating to bail. One bill adds a new section to the Penal Code to be numbered 1269a. It provides that all orders fixing bail and approving bail bonds shall be in writing. Another bill amends section 1306 of the Penal Code and requires the district attorney to collect judgments on forfeited bail bonds. The third bill amends section 1308 of the Penal Code by providing that no person against

whom a forfeited bail judgment exists can be accepted as surety on any other bail bond.

Bail continues to be one of the most troublesome features in the administration of criminal law. Numerous recommendations have been made to the commission suggesting remedies of existing evils. Much space is devoted to the problem by persons engaged in the study of crime conditions. A decided step forward was made in California in 1927 when the legislature enacted several new laws regarding bail. The summary judgment, following forfeiture of bail, has caused payments to be made in a larger percentage of cases and many abuses which formerly existed have been eliminated.

There is still room for improvement. The commission makes three recommendations relative to this subject:

1. Some judges fix bail over the telephone at night at the request of the bail bond brokers or court attaches without a knowledge of the facts of the case or without conferring with arresting officers. This practice usually results in low bail being fixed. In one flagrant instance where bail was fixed in this manner, the accused, who was charged with a felony, which later proved to be manslaughter, jumped his bail. Had the judge been acquainted with the facts in the case he would unquestionably have fixed a higher bail. The commission feels that bail should be granted only after careful consideration and with full knowledge of the facts of the offense of which the person is charged, and that in each felony case the court should make a written order fixing the bail. Also, in cases where an undertaking is filed, the court should approve the bail in writing before the accused is released. This, it is hoped, will require the judge to give more consideration to the amount of bail to be required and will reduce the number of cases where bail is forfeited.

2. While the legislature of 1927 provided that a summary judgment shall be entered in cases where bail is forfeited, no provision is made to insure collection of judgment in such cases. Section 1306 of the Penal Code should be amended so as to make it the duty of the district attorney to demand payment of all judgments against sureties on bail bonds within five days after such judgments become final. The section should also provide that if the judgment is not paid within ten days after demand has been made, the district attorney shall forthwith cause execution to be levied against the property of the judgment creditor.

3. In order to further insure the collection of forfeited bail bonds, courts should be prohibited from accepting any person as surety on bail if any summary judgments against such person has not been paid within ten days after such judgment becomes final.

ATTEMPTED EXTORTION

The commission submits and recommends the enactment of a bill amending section 524 of the Penal Code, relating to attempts to extort money or property by means of verbal threats.

The purpose of this act is to make attempted blackmail a crime. At present only successful blackmail is denounced as a crime and during the past two or three years there have been a number of bold attempts

at extortion by organized blackmailers. The purpose of this bill is to tighten up the law on the subject of blackmail.

ASSAULT WITH UNLOADED FIREARMS

The commission submits and recommends the enactment of a bill adding a new section to the Penal Code relating to drawing or exhibiting unloaded firearms or threatening therewith and fixing the punishment therefor.

Professor Vernier suggested to the commission that under the law of California it was no offense to draw or exhibit an unloaded firearm or to threaten therewith; that in order to establish the offense of assault with a firearm it is necessary to prove that it is loaded. Of course, the injury to the victim of such an act is the same whether the firearm is loaded or unloaded. The proof of the fact that the firearm is loaded in such cases is usually difficult, if not impossible, and in order to simplify the proof necessary and to protect unoffending persons from such threats, the above entitled act is submitted and recommended.

EXPERT TESTIMONY AND THE INSANITY PLEA

The commission submits and recommends the enactment of a bill providing that where the plea of not guilty by reasan of insanity is entered, the court shall appoint alienists selected from the staffs of the state hospitals for the insane to examine the defendant, investigate his sanity and report and testify upon the subject when his sanity is in question.

The purpose of the bill is to secure unbiased evidence in such cases as to the sanity of the defendant.

No worse scandal has transpired in the courts than that often attending upon the testimony of so-called experts upon the subject of insanity.

The commission believes that this bill is adapted to the correction of this evil by furnishing evidence that will not only come from those who are unbiased but will give juries the opinions of those persons of the medical profession who are best qualified to determine the mental status of the subject.

The state is sometimes at great disadvantage in such cases because it can not compete with wealthy defendants in procuring expensive experts. The additional duty placed by the bill upon the staffs of state hospitals will, we are assured, be gladly assumed by them.

The bill is also framed in the interest of those innocent defendants who in good faith plead insanity and are not financially able to secure the services of qualified experts to testify in their behalf. It will provide such innocent persons when accused of crime with adequate and unbiased evidence of their mental condition—evidence upon which both the defendant and the state can rely.

WAIVER OF JURY TRIAL IN FELONY CASES

On November 6, 1928, section 7 of article I of the constitution of the State of California was amended by the people. The amendment permits defendants to waive a jury trial in felony cases. At present a defendant in a misdemeanor case may waive trial by jury. This has

been permitted by our state constitution since 1879. July trials are frequently waived in misdemeanor cases. In fact, rarely ever are misdemeanor cases tried by a jury.

Waiver of jury trial in felony cases has been permitted in Maryland for more than a century. In Baltimore, in 1924 and 1925, approximately 90 per cent of all defendants in felony cases chose to be tried by the court rather than by a jury. The same privilege has been permitted in Connecticut since 1921. Since then jury trials have been waived in 70 per cent of the felony cases in that state.

Jury trials are slow and expensive. In California defendants are now given the privilege of choosing to be tried by the court alone, or by the jury. There are many instances when defendants feel that they could have a fairer trial by the court than by a jury, as, for example, in cases where great popular clamor, racial or religious prejudice is present. There are many reasons why persons charged with a felony will prefer a trial by the court rather than by a jury.

The extensive waiver of jury trials in felony cases will eliminate many delays and difficulties now experienced in criminal cases. Some of these are: time used in selecting jury, reversals because of erroneous instructions, misconduct of district attorney or jury. Much money will be saved to the taxpayers. Many debatable questions will also be largely solved, such as the right of the court to comment on the evidence, the right of the district attorney to comment on defendant's failure to testify, and whether a verdict should be returned by less than a unanimous vote.

The commission, after careful consideration, unanimously recommended this amendment to the people of this state. It is hoped that defense counsel, public defenders and district attorneys will readily avail themselves of this privilege and that a large percentage of felony cases will be tried by judges. The commission also desires to call this amendment to the attention of superior judges and respectfully requests that they, at some time prior to trial, advise defendants and counsel of this privilege now given under the constitution.

It is pleasing to note the attitude of some of our public officials toward this amendment. The following is taken from a joint statement by Mr. Earl Warren, district attorney of Alameda County, and Mr. Willard Shea, public defender of Alameda County.

> "This amendment was originally presented to the 1927 legislature by the Crime Commission and was designed to speed up and make more efficient the administration of criminal justice. The people by their recent vote have overwhelmingly approved of the system, and it is our opinion that every public official in the state should cooperate to the end that the law be made operative.
>
> We feel that all criminal cases are safe in the hands of the judges of our superior court, and we are willing that any and all such cases be tried solely by the court, thereby eliminating the necessity of taking our citizens from their homes and business to perform the ofttimes burdensome duty of jury service."

COUNTY JAILS

State institutions like Whittier, Preston, San Quentin and Folsom have always been subject to close public scrutiny. The fifty-eight county jails scattered throughout the state have, however, to a large extent, escaped the searchlight of public opinion. These jails are

inspected annually by the local grand jury or, occasionally, by a state officer. While our state institutions measure up well with similar institutions elsewhere in the United States, our county jails, except in a few instances, are far behind the modern concept of what a place of incarceration of this sort should be.

There are many reasons why this is so. In the first place it is quite natural that fifty-eight different communities should have different ideas as to what a county jail should be. The attitude of one community is that a clean, light, well ventilated and sanitary place should be provided in which to house jail inmates; another community holds to the view that it is a mistake to make a county jail comfortable and habitable; that if it is uninviting, offenders will not want to go or remain there. The cost of maintaining, altering or building county jails is a large item in county expenditures. Probably the item which is included in the annual county budget with the most reluctance is for the maintenance and repairs of the county jail. The board of supervisors is reluctant to spend several thousand dollars remodeling the county jail when that amount of money will just suffice to resurface a county highway or build a bridge, or do some other thing which appears to be more constructive.

The law at present provides for inspections of county jails, by two local and one state agency. The county board of public welfare (Stats. 1915, p. 339) consisting of seven members appointed by the board of supervisors, are required to visit and inspect the county jail once each quarter. This board of public welfare is required to memorialize the board of supervisors on any subject affecting county institutions which it considers needs correction. The grand jury is also charged with the duty of inquiring into the condition and management of public prisons within the county (P. C. 923). The State Department of Social Welfare is authorized to investigate, examine and make reports upon correctional and penal institutions of the counties, cities and towns (Stats. 1911, p. 1335; Stats. 1927, p. 86) of the state. None of these inquisitorial bodies have any power to condemn a city or county jail and prevent its further use. Their power is limited to inspections and recommendations.

In 1916 a report was made by the State Board of Charities and Correction entitled "A Study of County Jails in California." Many recommendations were made in this report relative to the construction of institutions for housing misdemeanants, but practically none of these recommendations have been carried out. Regarding the condition of these jails as breeding places for crime, the report stated at page 18:

> "When all sorts of men are thrown together in a cage or bull-pen, is it any wonder that our jails are not only breeding places for disease and vermin but also veritable schools of crime? Where outside of a jail would a life of vice and crime be so glowingly portrayed? Where else would methods of evading justice be so eagerly discussed? Where else would a youthful offender so easily make the acquaintance of hardened criminals? What more appropriate place could be selected for initiation into the fraternity of enemies of society?"

Very little change has been made in the condition of our county jails up to this time. The records in the office of the State Department of Social Welfare show that in many counties recommendations have followed inspections made by state authority and that recommenda-

tions have been made by grand juries, but that no attention has been paid to such recommendations by the boards of supervisors. The difficulty with the present situation is that there is no authority vested in any agency to require changes to be made in city or county jails where necessary.

The State Department of Social Welfare proposes to introduce a bill at this session of the legislature which will provide that the State Department of Social Welfare shall have the power to inspect and to condemn county or city jails which fail to measure up to minimum standards established by that department or by law. There can be no justification for the appalling inadequacy of some of our county and city jails. If insanitary, unhealthful and inadequate jail facilities were a cure for crime, as has been suggested by some persons, crime would have been eliminated long since. Present theories of penal treatment recognize the importance and economic necessity of rehabilitation rather than disintegration and demoralization, as applied to convicts. Certainly rehabilitation is not possible under the conditions provided by many of the city and county jails. Moreover, in these jails are to be found, not merely persons convicted of crime, but innocent persons who are being held for trial and guilty persons who, under the law, are entitled to the presumption of innocence and, what is even more important, innocent persons who are held in custody as witnesses in criminal cases. It is hard to justify the incarceration of such persons under any circumstances. It is impossible to justify their incarceration under the conditions existing in the jails referred to. Unfortunately, it has not been sufficient to call the attention of local authorities to these conditions and power must be placed in the hands of properly trained officers to educate local officials in terms of inspection and condemnation. The Crime Commission favors a bill along the lines proposed by the State Department of Social Welfare. The commission favors some procedure by which the orders of the State Department of Social Welfare condemning the use of jails or requiring the reconstruction or repair or other sanitary alterations to be made can be enforced. Some procedure such as is now provided by New York law should be adopted. In New York the State Commission of Prisons has the right to make orders affecting jails and can have its orders enforced by judicial proceeding. Some procedure of this sort should be adopted in California.

To show the progress made in New York as a result of the change in their law, such as here recommended, we quote from the report of the State Commission of Prisons for 1924, page 53:

> "At the last session of the legislature a law was enacted which authorizes the State Commission of Prisons to close any county jail that is insanitary or inadequate—a power which the commission did not hitherto possess except as applied to city jails and village and town lockups. Under this law, proceedings have been instituted against the officials of Albany and Oneida counties.
>
> Albany County for years has used a wing in the old penitentiary building for its county jail. It is inadequate at times to legally classify those committed to it and is without modern sanitary facilities. The board of supervisors has selected a site outside the city of Albany and proposes to erect a modern county jail.
>
> Oneida County has jails at Utica and Rome, as well as a jail farm near Rome. The commission has condemned the Utica jail and the board of super-

visors is to take up during the coming year a proposal to erect a new institution on the farm.

Several years ago the commission inaugurated a forward movement looking toward the reconstruction of the county jails throughout the state. Since that time scarcely a year has passed that the commission has not approved plans for some new or remodeled jails, so that at present, out of a total of 64 county jails 38 are modern in design, and all but seven of the others are listed as fair."

The commission is convinced that our present method of handling county prisoners is wrong. That the State Department of Social Welfare should be given ample authority and power to investigate and recommend such remedies as will solve this problem. The favorable consideration of the legislature is therefore asked of this measure to be introduced by the State Department of Social Welfare.

SELECTION OF PROBATION OFFICERS AND STANDARDIZATION OF PROBATION METHODS

Another bill proposed by the State Department of Social Welfare gives power to that department to establish standard methods of probation administration and standards for the selection, training and supervision of probation officers. In a few counties this work has been developed in a fairly creditable manner. Even in these counties much remains to be done. In other counties, very little has been accomplished and the results now being accomplished are much less impressive than they might be. State supervision of this work would be equally effective, as in the case of state supervision of school administration, of public health administration, of the administration of state institutions and many others. The people are entitled to a more intelligent administration of the probation laws. An intelligent appreciation of the importance of probation as a method of crime prevention requires that these laws be administered in such manner as to more nearly secure the results for which they are intended. The method proposed by the State Department of Social Welfare would contribute to the accomplishment of these ends.

STATE MOTOR VEHICLE OFFICERS

The California Vehicle Act is enforced by a corps of special officers known as inspectors and traffic officers. The salaries of these officers are paid by the state out of the motor vehicle fund. Twenty-two of these officers, out of a total of 297, are selected and appointed by the chief of the Division of Motor Vehicles; 275 are appointed by the chief of the Division of Motor Vehicles from lists of names proposed by boards of supervisors in the various counties in this state. The men selected from the lists certified by the board of supervisors operate in the counties from which the lists are certified. If the men so certified are not acceptable to the chief of the Division of Motor Vehicles, no appointments are made. This extraordinary method of appointment works for divided responsibility and control. In many cases officers who have been appointed from lists so certified refuse to obey orders issued by the Division of Motor Vehicles. The result is a general demoralization of the entire organization.

The commission favors a change in the method of appointment so that complete selection, appointment and control of these officers will be in the hands of the Division of Motor Vehicles. Only in this way can responsibility be placed and absolute control obtained.

BORDER PATROL

It has frequently been suggested to the Commission that highways leading out of the state should be patrolled by some competent police authority so that automobiles entering and leaving the state could be checked for stolen automobiles, concealed weapons, narcotics, intoxicating liquors and criminals. No adequate patrol is now maintained. The only check now being made at border points is by the State Department of Agriculture in the enforcement of agricultural quarantine laws protecting California agriculture against undesirable importations.

The appropriate authority to carry out this suggested patrol work is the State Division of Motor Vehicles. Officers whose duty it is to patrol the highways for traffic violations can easily maintain such a patrol at border points and be of material assistance in the identification and apprehension of criminals.

THE TELETYPE

The State Peace Officers Association, the State District Attorneys Association, the Bureau of Criminal Identification and other bodies have recommended the installation of the teletype. This is a system of rapid communication of information by telegraph from various local points to central distributing centers of information which makes possible the rapid collection and dissemination of information describing escaped criminals and their methods of operation and calling for assistance from peace officers in all parts of the state. Present day means of rapid communication and transportation available to intelligent criminals makes the provision of such a system a practical necessity. It would be absurd to expect a traffic officer equipped with a bicycle to overtake and capture a criminal in a high powered automobile. It is equally absurd to expect a peace officer to operate effectively with commercial telephone and telegraph facilities to capture criminals equipped with aeroplanes and other similar scientific machinery.

DEFENSE OF INSANITY

The legislature in 1927 amended sections 1016, 1017, 1020 and repealed section 1167 of the Penal Code. It also added two new sections, 1026 and 1026*a*. These changes were made to provide for a new plea of "not guilty by reason of insanity." Under the law as it now stands, if a defendant interposes this plea alone, he admits his guilt and is tried solely on the question of insanity. If he is found to be sane, he is sentenced by the court. Upon being found insane he is committed to the hospital for the criminal insane and must remain there for at least one year before he can again be tried for his sanity. Should the defendant enter two pleas, to wit: "Not guilty" and "not guilty by reason of insanity," he is first tried upon the issue of guilt or innocence. At this trial he is conclusively presumed to have been sane at

the time he committed the offense. If the jury returns a verdict of "not guilty" the matter is ended. If he is found guilty, he is promptly tried by the same, or a different jury, in the discretion of the court, on the issue of insanity.

The purpose of these changes in the law was to separate the issue of insanity from the issue of guilt or innocence. It was hoped thereby to prevent the introduction at one trial of a great mass of conflicting evidence as to defendant's mentality, together with evidence of the facts relating to the offense charged. The jury was often confused. The evidence of the mental state of defendant was frequently introduced to appeal to the sympathy of the jury. The plea of insanity was more often advanced as a way of escaping from a just sentence than in good faith as a correct explanation for the acts of the accused.

The constitutionality of these changes in the law is now determined. In *People* vs. *Hickman*, 76 Cal. Dec. 51, the Supreme Court upheld the law in cases where the plea of "not guilty by reason of insanity" was entered without the plea of "not guilty." In that case the court held that the defendant, by failing to enter a plea of "not guilty," admitted his guilt and elected to be tried on the issue of insanity alone and that he had not been deprived of his constitutional rights.

That tribunal has just handed down decisions in the cases of *People* vs. *Troche* and *People* vs. *Fook* in which it holds the law requiring defendants relying on the defense of insanity to enter a plea of "not guilty by reason of insanity," separately from the plea of "not guilty," to be constitutional.

The commission is of the opinion that these laws have eliminated one glaring evil in the trial of criminal cases, particularly capital cases. Until these decisions of the Supreme Court were handed down the status of the law remained in some doubt. Now that the law on the subject is definitely settled it is felt that no change should be made in the law at this time.

The commission was interested to know to what extent the new plea of "not guilty by reason of insanity" was being used and what bearing the defense of insanity had on the whole crime problem. The following table contains figures received from the district attorneys of this state. The period covered by the table is the year following the date the present insanity plea law went into effect.

Schedule of Felony Cases in California in Which Plea of "Not Guilty by Reason of Insanity" Was Interposed From August 1, 1927, to July 31, 1928.

County	*Information or indictments filed*	*Number of insanity pleas entered*	*Successfully urged*
Alameda (note 1)	432	14	6
Alpine	None	--	--
Amador	12	--	--
Butte	31	--	--
Calaveras	28	--	--
Colusa	--	--	--
Contra Costa (note 2)	60	2	--
Del Norte	3	--	--
El Dorado (note 3)	17	1	--
Fresno	275	4	--
Glenn	--	--	--
Humboldt	111	--	--
Imperial	143	1	--
Inyo	22	--	--
Kern	94	--	--
Kings	35	2	--
Lake	26	--	--
Lassen	33	--	--
Los Angeles	2,855	30	--
Madera	35	--	--
Marin	19	--	--
Mariposa	3	--	--
Mendocino	35	--	--
Merced	88	1	--
Modoc	--	--	--
Mono	None	--	--
Monterey	37	1	--
Napa	37	--	--
Nevada	16	--	--
Orange	204	1	--
Placer (note 4)	26	--	--
Plumas	--	--	--
Riverside (note 5)	275	1	1
Sacramento	238	3	1
San Benito	10	--	--
San Bernardino	250	3	--
San Diego	448	6	--
San Francisco	1,200	18	4
San Joaquin (note 6)	181	2	--
San Luis Obispo	35	--	--
San Mateo	61	--	--
Santa Barbara	65	--	--
Santa Clara	183	2	--
Santa Cruz	39	3	--
Shasta	39	--	--
Sierra	1	--	--
Siskiyou	15	--	--
Solano	16	--	--
Sonoma	54	--	--
Stanislaus (note 7)	138	1	--
Sutter	8	--	--
Tehama	--	--	--
Trinity	2	--	--
Tulare	220	1	--
Tuolumne	17	--	--
Ventura (note 8)	86	2	1
Yolo	38	--	--
Yuba	40	--	--
Totals	8,336	98	13

During the year following the enactment of the law providing for the new plea of insanity, that plea was entered 98 times in 8336 cases (53 counties) or in slightly more than 1 per cent of the cases. The plea was successfully urged in only 13 cases or in slightly more than 1 10th of 1 per cent of the total number of felony cases. Of the 98 times the plea was entered it was successful in only 13 cases or approximately 13 per cent. In the majority of cases where the plea was successful the district attorney either stipulated that the defendant was insane or the experts called by the people testified that the defendant was insane. This appears in the notes to the schedule which follow.

EXPLANATION OF INSANITY PLEAS

Note 1. Alameda County—Six Pleas.

No. 10162—*Manuel Vierra* (476 P. C. Fictitious Checks).

The record shows several prior convictions for similar offenses and also the fact that on each check the same bank, amount of the check and names were used. Dr. O. D. Hamlin, testifying for the people, said that the defendant in addition to being a chronic syphilitic showed clear symptoms of insanity and should be confined in an asylum.

No. 10175—*Warren Rodman* (146 California Vehicle Act. Theft of Automobile).

Prior to his arrest Rodman was a patient at the Livermore Sanitarium, and the chief witness for the defense was Dr. Clifford Mack, head of the Livermore Sanitarium, who testified that the defendant had definite mental symptoms and was an advanced case of dementia praecox. The man had no criminal record and was arrested a short time after the automobile was reported missing. Dr. Hamlin's examination for the people showed the same symptoms as testified to by Dr. Mack. The insanity was not contested by the people in this case.

No. 10200—*C. C. Hubbard* (Fictitious Checks).

The issue in this case was the present insanity and although, as of record, it shows a plea of not guilty by reason of insanity this issue was not tried and the charge still remains on record against the defendant. The district attorney's office did not oppose the recommendation of Dr. O. D. Hamlin that the defendant be confined in an asylum. Dr. Hamlin testified it was an advanced case of dementia praecox. The defendant was arrested for passing a fictitious check in the amount of $10, but investigation showed that he had passed forty other checks of $1 each, and had paid his expenses from Omaha to California by passing $1 checks. The information from the authorities at Omaha showed a trace of insanity in the family prior to their departure from Omaha to California.

No. 10215—*Robert Van Hatten* (146 California Vehicle Act. Theft of Automobile).

The defendant was a paroled inmate of Napa at the time the offense was committed. Dr. Hamlin testified for the people and said that it was a clear case of dementia praecox and the man was insane but not dangerous. Dr. Hamlin stated that in his opinion the man should be returned to Napa and held there until discharged as cured and not subject to parole.

No. 10233—*Henry Hetzel* (288 P. C. Lewd and Lascivious Act).

Hetzel at one time was an inmate of the Manhattan Hospital for the Insane in New York City and was discharged as cured. At the time of his arrest his brother was an inmate of the same asylum. His employer testified that while he was a good worker he was peculiar in his actions and speech. Dr. Hamlin testified for the people and said that the defendant was a case of dementia praecox of a type running in cycles. He would be sane for a period and then become morose and depressed. During periods of depression his emotions became aroused and too dangerous to be be at liberty. While he knew the difference between right and wrong, he should be confined in order that when he became emotional that he would not be liable to commit offenses similar to that for which he was arrested.

No. 10282—*George C. Webster* (476a P. C. Fictitious Checks)

Plea of insanity in this case was vigorously opposed by the people on the ground of the defendant's past record. The evidence tended to show that the money derived from passing checks was used to purchase dope. Dr. Hamlin testified that the defendant was not insane in a dangerous degree but was a confirmed dope fiend. That he would take any sort of chance and commit any crime in order to obtain dope. He believed that the defendant should be confined in an asylum and an effort made to cure him of the habit.

It will be noted that in only one of these cases did this office oppose the plea. In the other cases our own experts either testified that in their opinion the defendant was insane or we failed to introduce any testimony on that score, relying on their opinion that he was insane.

Five of these cases were either for bad checks or violations of section 146 of the vehicle act. Prior to the adoption of the insanity amendment we would not have tried these men for felony believing as we did that they were insane, but under the section as it now stands I conceive it to be our duty in doubtful cases to charge the defendant with the crime he committed and permit the jury to pass upon the question of his sanity. If he is considered sane by the jury he goes to the penitentiary and if insane he must be confined for treatment in a state hospital for at least one year." EARL WARREN, District Attorney, Alameda County.

Note 2. Contra Costa County.

"In each case, after the defendant was found guilty of the crime he withdrew his plea of 'not guilty by reason of insanity'." ARCHIBALD B. TINNING, District Attorney

Note. 3 El Dorado County.

"• • • the only case in which insanity has been interposed is the case of the *People* vs. *Troche* now on appeal in the Supreme Court and as yet undecided." HENRY S. LYON, District Attorney.

Note 4. Placer County.

"There have been four women acquitted for murder in this county on the insanity plea. All of these cases were tried a good many years ago, but they have sort of

worn out the effectiveness of that plea. This accounts for the absence of it in the past few years." ORRIN J. LOWELL, District Attorney.

Note 5. Riverside County.

"This man was committed to an institution for the insane and we concede that he is insane." ALBERT FORD, District Attorney.

Note 6. San Joaquin County.

"In one case the plea was withdrawn before trial, and in the other case the plea was unsuccessful." GUARD C. DARRAH, District Attorney.

Note 7. Stanislaus County.

"• • • before the date of the trial the defendant withdrew said plea, and therefore the jury did not pass upon it." R. R. FOWLER, District Attorney.

Note 8. Ventura County.

"• • • but only one of these pleas going to trial, the defendant in the other case withdrawing his plea and pleading guilty. In the case which went to trial the jury found the defendant guilty, and an appeal was taken to the appellate court; the judgment being affirmed. The title to this case is *People* against *Pettinger*." JAMES C. HOLLINGSWORTH, District Attorney.

SUMMARY OF SUGGESTIONS ACCORDING TO SUBJECTS

After reading the suggestions received in communications responsive to our questionnaire, we classified them according to subject matter and summarized them for study. In that form they are here incorporated in our report. Many of the thoughts expressed and ideas advanced are deserving of further study. The summary will be found in the appendix. Several communications dealing more or less exhaustively with particular subjects have also been inserted in the appendix.

CONFERENCES AND MEETINGS

It was the policy of the commission to hold a general meeting of the commission at least once a month. The meetings were alternated between northern and southern California as near as possible, inasmuch as the membership of the commission was divided between the northern and southern portions of the state. In some instances the commission acted in sections, those members residing in the northern part of California acting as the northern section, and those residing in southern California acting as the southern section. Following is a list of the meetings held with a brief statement of occurrences:

October 13, 1927—Organization meeting at Sacramento.

November 17, 1927—Executive session at San Francisco.

December 16-17, 1927—At this meeting the following officials of the city and county of Los Angeles conferred with the commission: Frank Paden, Deputy Public Defender; James E. Davis, Chief of Police of Los Angeles; Donald MacKay, Deputy District Attorney; A. H. Van Cott, Deputy District Attorney of Los Angeles County; Carlos S. Hardy, Judge of the Superior Court; Charles S. Burnell, Superior Judge; William C. Doran, Superior Judge; John F. Pullen, Superior Judge of Sacramento County, then presiding in Los Angeles County; Frank C. Collier, Superior Judge; William T. Aggeler, Superior Judge; Charles W. Fricke, Superior Judge; Edward T. Bishop, Superior Judge; Victor R. McLucas, Superior Judge; Leon R. Yankwich, Superior Judge; Frederick Vercel, Public Defender; Frank Nance, Coroner.

January 9, 1928—At this meeting held in San Francisco, the commission conferred with the following persons: Duncan Matheson, Captain of Detectives; Dr. T. W. Leland, Coroner; William H. Nichols, Adult Probation Officer; W. J. Fitzgerald, Sheriff; Dr. Thomas W. Huntington; Mrs. Ingram B. Slocum, Member State Commission on Institution for Women Offenders; Mrs. Walker Arnstein, Temporary Chairman, Juvenile Probation Committee of San Francisco; Hugh Martin Young, Attorney at Law; J. C. Astredo, Chief Probation Officer, Juvenile Court, Joseph M. Gwinn, Superintendent of Schools; Dr. Edward W. Twitchell; James G. Conlan, Judge of the Superior Court; Joseph M. Golden, Judge of the Police Court; S. J. Lazarus, Judge of the Police Court; Frank Egan, Public Defender, and E. M. Hirschfelder.

January 31, 1928—This meeting was held in the office of Commissioner W. H. Holland in Los Angeles. The following persons addressed the meeting: Eugene W. Biscailuz, Under-Sheriff of Los Angeles County; K. J. Scudder, Superintendent of

Whittier State School; Otto E. Kramer, Probation Officer, Santa Barbara County; Dr. Blank, County Jail Physician, Los Angeles County; B. J. Scheinman, Deputy District Attorney; Clay Clayberg, Probation Officer of Ventura County; Allan A. Carter, Parole Officer, Probation Department, Los Angeles County; Mrs. Elizabeth McManus, Chairman, County Probation Committee, Los Angeles; Carl L. May, Supervisor, Adult Probation Department, Los Angeles County; L. D. Haskell, Boys' Supervisor, Probation Department, Los Angeles County, and A. J. Wingard, Assistant Probation Officer, Los Angeles County.

February 3, 1928—Meeting held in Oakland addressed by following persons: Howard L. Bacon, Police Judge; Donald Marshall, Chief of Police; Willard Shea, Public Defender; Earl Warren, District Attorney; Leon E. Gray, Superior Judge of Alameda County.

At the meeting held in Berkeley on the same day the following persons spoke: Cavendish Moxon, Psychoanalyist; Samuel C. May, Professor of Political Science, University of California; Fred Athearn, Attorney at Law, Berkeley; M. P. McBaine, Dean of the Missouri Law School; Mrs. Anna L. Saylor, Director, State Department of Social Welfare, August Vollmer, Chief of Police of Berkeley; Frank R. Devlin, Attorney at Law of Berkeley, and Mrs. E. H. Noble, Associate Professor of Social Economics, University of California.

March 14, 1928—At this meeting, which was held in the Governor's Office, State Building, San Francisco, the following persons sat in conference with the Commission: Daniel J. O'Brien, Chief of Police of San Francisco, George J. Hatfield, United States Attorney; Dr. Samuel C. Kohs; Frank Benson, State Narcotic Director; Theresa Meikle, Attorney for State Board of Pharmacy.

March 15, 1928—This meeting was held at San Jose, the following persons speaking: Fred L. Thomas, District Attorney of Santa Clara County; F. B. Brown, Judge of the Superior Court of Santa Clara County; J. N. Black, Chief of Police, San Jose; George W. Lyle, Sheriff of Santa Clara County; N. P. Sinnott, Sheriff of Santa Cruz County; Max Watson, Adult Probation Officer of Santa Clara County; George P. Dennett, Probation Officer of Santa Cruz County; J. R. Welch, Judge of the Superior Court of Santa Clara County; Percy O'Connor, Police Judge of San Jose; Leonard Stocking, Medical Superintendent, Agnew State Hospital; Mrs. Bessie A. McDonald, Probation Officer, Santa Clara County; Herbert Jones, State Senator, Santa Clara County.

A meeting was held at Stanford University in the evening of the same day at which time the following persons spoke: Chester G. Vernier, Professor of Law; Clarke B. Whittier, Professor of Law; A. M. Cathcart, Professor of Law; Dr. Margaret Lathrop, Instructor in Economics; Professor George Edward Osborne; Dean M. R. Kirkwood, School of Law; and Professor Stanley Morrison all of Stanford University; E. D. Lakin, Justice of the Peace, Palo Alto.

April 1-2, 1928—A meeting was held at the Whittier State School in conjunction with the Commission for the Study of Problem Children. The work of the two commissions was outlined and the activities of both were discussed so as to avoid, as far as possible, overlapping.

At the meeting on April 2, 1928, held in the offices of Mrs. Elizabeth McManus, Chairman of the Los Angeles County Probation Committee, Hall of Records, Los Angeles, the following persons spoke: Mr. Francis H. Hiller, Field Representative of the National Probation Association; Dr. Paul E. Bowers, Neuro-Psychiatrist of Los Angeles; Dr. E. Van Norman Emery, Director, Los Angeles Child Guidance Clinic; Judge Myron Westover, Judge of the Municipal Court of Los Angeles; Dr. J. Harold Williams.

April 24, 1928—This meeting was held at Sacramento in the Lieutenant Governor's office, State Capitol. The following persons addressed this meeting: Clarence Morrill, Superintendent State Bureau of Criminal Identification and Investigation; Court Smith, Warden, Folsom Prison; T. N. Koening, Chief of Police, Sacramento.

On April 25, 1928, the Commission met with the Governor's Counsel. Interesting reports were rendered by several state department directors. In the afternoon the Commission met with the Commission for the Study of Problem Children at Room 406, State Capitol. Mr. O. H. Close, Superintendent, Preston School of Industry, made extensive remarks to the members of both commissions.

May 23-24, 1928—This meeting was held in Yosemite Valley in conjunction with the annual meeting of the California Conference of Social Work, which conference represented social workers of Washington, Oregon and California.

On May 23, 1928, the following persons spoke before the Commission: Miss Helen D. Pigeon, Executive Secretary, National Association of Policewomen, Washington, D. C.; Mrs. Rose B. Wallace, Chairman, Commission on Institution for Women Offenders; Theresa Meikle, Attorney, State Board of Pharmacy, San Francisco; Mrs. Gertrude Slocum, Member, Commission on Institution for Women Offenders; Miss Allida C. Bowler, Director, Division of Public Relations, Los Angeles Police Department; Mrs. Catherine Edson, State Industrial Welfare Department; James E. Davis, Chief of Police of Los Angeles.

On May 24, 1928, a meeting was held at the Antlers Club, at which time the following persons spoke: James E. Davis; Earl E. Jensen, Director, Department of Institutions; O. H. Close, Superintendent, Preston School of Industry, Ione; Mrs. Irma Wann Buwalda, Member, Commission on Institution for Women Offenders, and Max Watson, Adult Probation Officer, Santa Clara County.

June 21-22, 1928—This meeting was held at the Del Monte Hotel, Del Monte, California, in conjunction with the Eighteenth Annual Convention of District Attorneys' Association of California. Earl Warren, District Attorney of Alameda County, read the report of the Legislative Committee appointed the previous year. Hugh K. McKevitt, representing the California Northern Hotelmen's Association, spoke on a proposed amendment to certain sections of the Penal Code relating to fictitious checks.

Henry Lyon, District Attorney of El Dorado County, spoke on prohibition enforcement. The assistant district attorney of Sacramento County gave some sidelights on the recent revolt at Folsom. The second session of the Convention was held on June 22, 1928, jointly with this Commission. Subjects which this Commission previously suggested for discussion by a questionnaire sent to all the district attorneys were considered.

July 19, 1928—This meeting was a section meeting held at the office of the Chamber of Commerce at San Francisco. The following credit men were present: John L. Clymer, Retail Merchants Association of San Francisco; R. S. Martin, Retail Credit Association of San Francisco; Frank K. Runyon, Retail Furniture Dealers Association of California, and Richard N. Neustadt, California Retail Council. Sections 476 and 476a of the Penal Code, relative to the issuance of fictitious checks, was discussed.

August 6–7, 1928—Several members of the Commission attended a meeting of the Commission for the Study of Problem Children held at the University of California. The following persons spoke: Dr. Herman Adler, visiting Professor of Criminology at the University of California, and Professor of Criminology and Head of Department of Social Hygiene at the Medical College, University of Illinois; Miss Meredith of New York, member of the Visiting Teacher Movement, and A. M. Kidd, Professor of Criminal Law, University of California.

August 30–31, 1928—This meeting was held at the office of the Attorney General, State Building, San Francisco. At the meeting on August 30 the following subjects were taken up and discussed: Waiver of Jury Trial in Felony Cases, Recommendation of Subjects for Discussion by the State Bar of California, Receivers of Stolen Goods, Prison Labor and Industries, Firearms Law, Indeterminate Sentence and Habitual Criminal Act. On August 31, Commissioners Beasly, Miller, McKay and Secretary Fox submitted a report containing questions to be submitted to the various sections of the State Bar of California on Criminal Law and Procedure. The questions were sent to O. K. Cushing, Governor of the State Bar of California in charge of section work. The Commission discussed the following subjects: probation, parole, state department of justice, and intermediate prison.

September 10, 1928—This meeting was held at the Mendocino State Hospital at Talmage, near Ukiah, in conjunction with the bimonthly conference of the superintendents of the California state institutions. The following persons entered into the discussion: Senator Fred C. Handy, State Senator; Dr. G. M. Webster, Medical Superintendent, Patton State Hospital; Dr. Fred P. Clark, Medical Superintendent, Stockton State Hospital; Earl E. Jensen, Director of Institutions and exofficio member of the Governor's Council; Dr. Leonard Stocking, Medical Superintendent, Agnew State Hospital; Dr. Edwin Wayte, Medical Superintendent, Norwalk State Hospital; Dr. Donald R. Smith, Medical Superintendent, Mendocino State Hospital; Dr. Geo. W. Ogden, Medical Superintendent, Napa State Hospital, Dr. Rapaport of Mendocino State Hospital.

October 11–12–13, 1928—This meeting was held at the Huntington Hotel, Pasadena, California, in conjunction with the annual meeting of the State Bar of California. A conference was held with Senator Chester Kline of San Jacinto, California, relative to prison labor and prison industries problem. The Commission considered the following subjects: Receivers of Stolen Goods, Report to be submitted to the Legislature; proposed legislation of the Department of Social Welfare, Habitual Criminal Act, Teletype System, Bureau of Criminal Identification, Criminal Statistics, Compromise of Criminal Cases and bail bonds.

October 24, 1928—This was a meeting of the northern section of the Commission held at San Francisco in the office of the Attorney General. The section considered an article prepared by Professor Vernier of Stanford dealing with the record of appeals in criminal cases in California from the date of the organization of the Supreme Court of California to 1926. Discussion was also had relative to the defense of insanity in criminal cases.

November 15–18, 1928—Meetings were held at San Bernardino in conjunction with the annual convention of the Peace Officers Association of California. Several members of the commission took part in the deliberations of the Peace Officers Association. Executive sessions were held at San Bernardino and at the University of Southern California, Los Angeles.

December, 1928—Many meetings were held in San Francisco and Sacramento, attended chiefly by Chairman Johnston, Commissioners Beasly and Webb and Secretary Fox. Much of the time of these meetings was spent in putting the proposed bills and the report of the commission in final form.

CONCLUSION

The work in which the Crime Commission has been engaged since its creation, the meetings held, the communications received, the suggestions and proposals offered for consideration, the wide field to be covered, the great importance of the questions involved in the undertaking to prevent, combat, and repress crime demonstrate clearly the necessity for some permanent body to insure continuous study of the problem and to coordinate the work of many agencies performing a part in its solution. Whether this shall be done by extending the work and adding to the duties of some existing bureau of the state government, by a

continuing Crime Commission or by organizing a department to deal especially with it is, of course, a question which must be decided by the legislature.

It may be safely said that the changes in criminal procedure which were adopted at the last session of the legislature have been well received and are working well. We believe the measures we are recommending likewise will be effective. But legislation regarding procedure and penalties is not sufficient. The greatest difficulties are in the fields which precede the trial and in fundamental social, economic, educational and other conditions contributory to crime. It is in these fields that much remains to be done. Provision must be made for continuous and thorough expert field studies of crime causes so that we may have incontrovertible facts to guide us in the best methods of preventing, detecting and apprehending as well as prosecuting and penalizing.

Respectfully submitted.

JAMES A. JOHNSTON, *Chairman.*
W. A. BEASLY,
BURON FITTS,
W. H. HOLLAND,
WILLIAM R. MCKAY,
JUSTIN MILLER,
U. S. WEBB,
Commissioners.

CHRIS B. FOX, Secretary.

APPENDIX I

Digest of Written Communications to the Commission from Many Officials and Citizens

(These communications were received in response to letters written to persons, official and nonofficial, whom the commission thought might be able to make useful and practical suggestions. This digest and communications are inserted here with the thought that the information and opinions thereon will be useful for future study.)

APPREHENSION

Another very weak place in our method, or lack of method, is gathering the evidence on which our prosecuting officers have to make their case. A crime is committed. A sheriff who probably owes his election to being a good fellow, rushes to the scene with a squad of deputies, and proceeds to tramp out and obliterate every important bit of evidence. This is true perhaps only of the rural districts, but is probably duplicated to a certain extent in the cities by the police. I believe that the Bureau of Criminal Identification should have a staff of highly trained men scattered, or rather stationed, over the state whose duty it would be to go at once to the scene of a crime, and gather and prepare the evidence. (R. F. Fisher, Assemblyman, Carlotta.)

The second phase of the question is that of meeting a concrete situation that exists and holding it in check by detection and prosecution rather than prevention, or perhaps, in addition to prevention. In this respect, I believe that the greatest breakdown takes place in the apprehension of the criminal and the scientific gathering and presentation of evidence of his guilt. We hear a great deal about the paucity of crime in England, France, and Canada. But when we stop to consider the territorial extent and geographical position of the first two and the inability of the violator to escape therefrom, together with the fact that both of these governments maintain a highly skilled and expert organization for the apprehension and conviction of criminals, it is not difficult to understand. Scotland Yard in England, and Surette in France, and the Canadian Mounted Police in the last named country are governmentally maintained organizations of experts that know how to gather evidence, catch the criminal and procure his conviction. How many times has any lawyer familiar with the trial of criminal cases seen a policeman or deputy sheriff who knew no more about the scientific detection of crime than the man in the moon, take the witness stand and by reason of his own stupidity creates a doubt, and a very reasonable doubt, in the minds of the jurors? Send a half dozen ordinary deputy sheriffs who are good farmers or artisans to the scene of a murder and they will trample all over the evidence, destroy everything of any value, and then go into court and contradict each other on half a dozen material facts and be uncertain as to that many more. Of course, this is not so generally true in the large cities, but in the average county a sheriff is elected because he can get more votes. He goes in without knowing anything whatever about the scientific methods of detecting crime and apprehending the perpetrators and by the time he has held office for four years and acquired some idea of how to go about such things someone else is elected and the process of education goes on. It is practically impossible to obtain the services of deputies who have sufficient knowledge of modern methods of crime detection to enable them to cope with conditions that exist.

I would suggest the creation of a department of justice or something of a similar nature by the state to work in conjunction with the Bureau of Criminal Identification. The personnel would be comprised of highly skilled operatives who would participate in the solution of all major crimes, particularly with a view to procuring satisfactory evidence to support a conviction. Certainty of apprehension is the one deterrent. If every person that planned the commission of a crime were morally certain of being caught, the crime in the great majority of cases would not be committed. (Vernon F. Gant, Attorney at Law, Modesto, California.)

It is very evident that many of the young men and boys received by the Preston School of Industry have had very little fear of being caught, and felt that if they were caught they could, through employing a clever attorney, succeed in beating their case. They have ample reasons for forming these opinions. An investigation in two of the leading cities of Missouri sometime ago revealed the fact that whereas

information had been filed with the police concerning approximately fourteen thousand major crimes, arrests had followed in only eight per cent of the cases. It was furthermore revealed that only three per cent of the total number had been found guilty and punished. It is very evident that in America the police forces are inefficient. This is partly due to political interferences, but in many instances it is chiefly due to the small number of police employed.

The European countries employ much larger forces than does America. The police are also much better trained. European countries, I am informed, rely more on police protection than upon severe sentences to prevent crime. California should not only see that the city police departments are enlarged and made more efficient but should, after the next session of the legislature enact laws creating a state constabulary large enough to properly deal with the crime conditions in this state.

California has a large floating population that moves about the state doing seasonal labor. Many useless people of all classes flow into this state, many of whom are criminals from other states. Others, although not definitely criminals, commit crimes because of economic necessity or bad associations. In my opinion the state can not expect to cope with the crime problems now confronting it until a well-established state police is a reality. A state police force will do more to check crime in this state than any other single movement. (O. H. Close, Preston School of Industry.)

After a careful study, I find that in many of the major crimes the automobile plays an important part. The stolen automobile can be associated with at least seventy per cent of these crimes, being used either as a means of a get-away or to hide the identity of the person or persons committing the crime. I feel that with the prompt and speedy cooperation of local police departments and sheriffs' offices, with this department, in notifying this office immediately when an automobile is stolen in their vicinity, we can broadcast throughout the state to be on the lookout for these automobiles. Due to our system of highways and our controls by traffic officers, it would be almost impossible for these criminals to be at large for any length of time without being apprehended. (Frank G. Snook, Chief, Division of Motor Vehicles.)

I know of no city which has a sufficient number of police officers since the automobile has come into common usage for the reason that so many officers had to be taken from the ranks of the various police departments for the purpose of handling traffic. Formerly these officers were assigned to duty for the purpose of apprehending criminals, and preventing crime, but since their assignment to traffic work, officers have not been added to the various departments to replace them, and for this reason more officers should be added to handle the criminal end of the police work. (T. N. Koenig, Chief of Police, Sacramento.)

When a criminal perpetrates a crime, his thought is not what may be his punishment or how much that punishment may come, but his thought is how can he commit the offense without being apprehended. Therefore in order to deter that man or woman from committing the criminal act he must have a fear of immediate apprehension by the police power of the state. Therefore instead of adopting legislation pertaining to the procedure in criminal cases, it appears to me that some constructive means should be adopted to aid the peace officers of the state in apprehension of criminals. There seems to be at present little or no cooperation between the sheriffs of the different counties. The State Bureau of Criminal Identification was organized in an effort to establish a bureau through which such officers might cooperate with one another. While its purpose is good, it does not appear to be functioning to the proper end.

It appears that there should be a chief constabulary of some sort to guide and control the work of all peace officers throughout the state, thus bringing all the various departments under one powerful head that would be a fear to every man contemplating a criminal act. (Harry W. Falk, Judge, Superior Court, Humboldt County.)

As a general proposition my personal conclusions are that the best method of [illegible] criminal justice and reducing crime is to eliminate extreme care on the part of prosecuting officers when investigating a case. If it is reasonably determined that a prosecution cannot be had to conviction, it seems to me it would be well to dismiss proceedings for the reason that prosecutions without conviction encourage the hiring and arming of criminals who accept such cases, and encourage them to commit a more serious crime with each case so as to be free and confident on account of their past. Of course, this suggestion does not apply where a mere pass as well as proper care a reduction of prosecutions that fear of conviction will [illegible] the [illegible] of the community [illegible] to the [illegible]

convictions. On the contrary, I believe that every strong case should be prosecuted vigorously, and in such cases that no leniency be allowed excepting for more extraordinary reasons. (Peter O'Brien, Chief of Police, San Rafael.)

The initial difficulty under present conditions comes in the detection of crime. The bulk of the crimes are pretty well taken care of by our present police force, that is, most of the criminals are discovered and arrested. However, there is a very considerable portion that are never detected. A skillful burglar or a resourceful hold-up man or other criminal is able to get away and escape even arrest. I think this is due to the lack of a detective force. We are relying upon the ordinary patrol force to detect criminals as well as to preserve order. The two functions are far removed from each other and this ought to be recognized by law. We get pretty good policemen by our present methods, especially in the cities where rigid tests are imposed on applicants for the force, but the ability to follow up clues that lead to the arrest of a skillful criminal is of altogether another nature. I would recommend the establishment of a special detective force which should be trained along the lines of observation, reasoning and scientific knowledge such as is found in some of the European police bureaus and as illustrated here by Dr. Heinrich. Every precaution should be placed in the law to prevent this from being made a political position. There should be a rigid examination as to qualifications, education, aptitude, and knowledge, with reasonable security of employment for those who pass the tests. (Earle A. Walcott, Executive Secretary, Commonwealth Club.)

Appoint a group of not less than a dozen trained and scientific investigators and scientists for the purpose of assisting in tracing down professional criminals or uncovering clues in serious crimes. (August Vollmer, Chief of Police, Berkeley.)

BAIL

That where a defendant charged with felony, after his arrest and notification of the charge against him and his release on bail and having the knowledge that he must appear in court on a certain day and defend himself against the charge, fails and refuses to appear, by taking flight for instance, there should be a statute to the effect that the trial can be had on the day appointed even though the defendant is absent. It seems to me that if he refuses to face his prosecutors on the day set for trial or for preliminary hearings and takes flight that such an act on his part will be considered a waiver of his presence and the trial should take place in his absence and a verdict rendered in his absence and, if a conviction is had, such conviction shall stand as a judgment in the case for all time.

If such a law is passed it would prevent criminals who obtain a release on bail from defeating justice by remaining away for several years and then returning after the witnesses are dead or departed from the state.

In addition to the above there should be some legislation tending to improve conditions regarding release on nominal bail or insufficient bail of prisoners charged with felonies like robbery, burglary, or such aggravated offenses. I have heard of cases where such defendants, having been released on light bail, have departed for parts unknown, whereas had the bail been made quite large they would have been kept in custody and placed on trial on the day set.

One remedy for the above might be a statute requiring the judge in setting the bail to hear the the evidence of the arresting officers or the chief of police regarding the character of the accused and the circumstances of the crime. Very often at the present day the counsel for the defense appears before the judge and states only his side of the case and obtains an order for light bail or bail in a small sum. (Edmund P. Morgan, Judge of the Superior Court of San Francisco.)

CHECKS

It is my view that the public have much more ample means of protecting themselves against bad checks than the law has of protecting them. On the other hand, the public feel a false sense of security from the fact that the law forbids these frauds. If check cashers realized the ineffectiveness of criminal prosecutions and knew that they must rely exclusively upon their own self-protection, would not they be in a safer situation? A false or ineffective quarantine frequently is worse than none at all.

The public in fact take all the risk with no real effective assistance from the criminal law. If it were no longer to be an offense to issue a check without sufficient funds, the check casher would know just exactly where he stood and what chances he was taking and would act upon his own responsibility. * * * My idea

would involve the repeal of all the check laws except that it would be a forgery to sign the name of another person to a check. (Orrin J. Lowell, District Attorney, Auburn.)

Make the acceptance of bank checks civil matter; remove the penalty for issuance of bad checks, except in forgery and kindred cases. (W. W. Sublet, Sheriff of Shasta County.)

I also advise, after many years of experience that we cause sections 476 and 476*a* of the Penal Code of the State of California, to be stricken out, as I believe these sections to cause crime, rather than to prevent crime. Should this law be canceled, there would be few bum checks cashed, and the peace officers of the state would not be made collection agencies. (E. H. Gum, Sheriff of Placer County.)

I would suggest the advisability of passing, or rescinding laws in the following matters: First, make the acceptance of a bank check a civil matter, by removing the penalty for drawing a check without sufficient funds to meet it. In the last forty warrants listed in the sheriff's office at this place, warrants not served on account of failure to find the defendant, 18 are for bad checks, some for as little as four dollars. The men that took them can not give a reasonably good description of the drawers, but expect the officers to hunt them down and get their money back. (James L. Richardson, County Probation officer, Shasta County.)

CAUSES OF CRIME

There is, I think, no doubt that there are many contributing factors to the prevalence of crime in this country at the present time. To my mind the most important of these is the failure of the authorities to get even a reasonable per cent of convictions. (R. F. Fisher, Assemblyman, Carlotta.)

In the first place, I take it that we are passing through a stage of very pronounced social and moral evolution. Standards that have endured for centuries have have been swept away in recent years and a process of readjustment is going on that has resulted in a general disturbance of society at large and has been reflected, to a certain extent, in crime and criminal activities. I have in mind particularly the altered status of women and the experiment with prohibition. There has also been a marked trend toward commercialism and greed with a corresponding enhancement of material values at the expense of moral principle. Congestion of population in the large centers—urbanism—has progressed to tthe extent of a well defined movement. All of these things and more of a similar nature that might be mentioned I consider the basic *causes* of the abnormal prevalence of crime. (Vernon G. Gant, Modesto.)

In general terms, we would state that one of the greatest contributing elements to crime is that people generally have no Christian training, and Christian influences are lacking in the home. Another great contributing cause of crime is that our youth is painstakingly educated in birth control; therefore creating an incentive for promiscuous cohabitation. This instruction, we feel, should be very carefully and properly given; and not as a medium of contributing. (W. B. Young, Probation Officer, Stockton.)

Not all our criminals are criminals because of environment. More and more of them come from good homes and stand high in classrooms. I am not a religious man, but I firmly believe that religion is the best foundation for character building. If the teachings of Christ could find a place in our schools they would certainly hurt no one. Army chaplains of all creeds get along together and teach in a nonsectarian way, and do much good in our army schools. The teachings that the only thing that distinguishes man from the beasts is that he has an immortal soul is certainly not a harmful one. If parents or schools taught the Ten Commandments it would help a great deal. We used to blame crime on lack of education and poverty. We can not do this any longer—to any great extent. (W. D. Potter, Berkeley.)

A considerable portion of criminality, not all or nearly all, but a part at least arises out of delinquency, and delinquency may be roughly charged, 50 per cent to broken homes, half as many more to no proper guardianship in homes, both parents at work all day, children running the streets, boys imitating their fathers' example, border line cases of feeble-mindedness, no place to play, every animal must, be it mouse, man or whale. Add undernourishment. New York found that taking street Arabs off coffee and sinkers and feeding wholesome food and plenty of it made good boys out of bad as a general experience.

In later life comes failure to make a living by the wits without ever having learned how to do anything that society wanted to have done badly enough to pay

for it, the fellow who can do "most anything" but so indifferently as to be among the first discharged when reducing the force. General no-accountness, life's failures, drink, drugs, syphilitic infection; sometimes a craving for adventure and sometimes criminal instincts, not more frequent, perhaps, than "natural born prostitutes,"—very rare.

Chiefest cause of all, perhaps, and fundamental with all, is disobedience, at home, school, shop—everywhere, having all their lives known no master but their own undisciplined wills. (A. J. Pillsbury, Berkeley.)

COST OF CRIME

Crime costs billions of dollars in this country. Several years ago the estimate of $70,000,000 was made as the cost in California. By this time it is greatly in excess of that figure. If, then, a substantial reduction in this cost can be made, it is worth paying a considerable amount of money. If it were not for political considerations, there would be no difficulty in appropriating the sums necessary. Left to business men as a business problem, it would be simple. If $20,000,000 can be cut off the $70,000,000 cost, it is worth spending $10,000,000 in a lump sum and $1,000,000 a year to keep up the reduction. How foolish it is to argue that the judge must not grant probation, nor the prison directors parole, but keep criminals in for a long period of time, if, as a matter of fact, they can't hold those who are already there. No business man lets his production department outrun his sales department. The problem must be considered as a whole. Wherever the machinery is not working, the condition must be remedied. If, for example, there is a delay between the preliminary examination and the trial, why is this so? Perhaps investigation will show the transcript of the testimony is not written up in time. Either there are not enough stenographers or they are not working. In a business, these things would be taken care of. But there is no president or manager or superintendent to keep the departments of the criminal law enforcement bureau working harmoniously. (A. M. Kidd, Professor of Law, University of California.)

COURT'S DELAY

I wish to state that: Speed up the machinery of the law in dealing with crime. There are too many delays, postponements, and continuances, in our criminal cases. The longer a case drags on, the less chance of conviction. The attorneys for the defense always spar for time. When conviction is secured, ordinarily it comes so long after the commission of the crime that the greater part of its deterrent effect is lost. Swift and certain court procedure is what is wanted, with some assurance of finality in the shortest possible time. Persons charged with crime should be promptly tried, and whether found guilty or acquitted, have it over with. Action is what is wanted. (Jas. B. Holohan, Warden, San Quentin.)

I entertained the hope that the new laws would result in marked improvement. It is all right to give criminals a fair trial, but is unfair to society to have so much red tape in the prosecution as to give crafty lawyers an opportunity to so delay trials as to scatter witnesses, and defeat justice. (Cadet Taylor, State Senator, Pomona.)

A delay in bringing criminals to trial before a jury is a very potent cause of the failure of justice. Witnesses disappear, recollection becomes uncertain and the resentment of the injured dies down to a feeling of "Oh, what's the use?" The result is a distinct encouragement of crime. (E. A. Walcott, Executive Secretary, Commonwealth Club.)

That there be no unnecessary delay in bringing the case to trial, or in pronouncing judgment; to see that appeals when taken are not delayed, and that certain and prompt punishment is administered to the convicted. (J. A. Allen, Judge of the Superior Court, Tulare County.)

We should seek to prevent technical delays and obstacles in criminal cases. It not only keeps the prisoners in torture of mingled hope and fear, encouraging agitation for and against them, but injures the name of the state's justice.

The worst thing about the delays, in my opinion, is that most of them, are of no real value at all, either to the prisoners or the state, because we generally never really obtain a new trial, or make the case subject to review on its merits by any other tribunal than the one that decided it in the first place. This defect, I believe, should be done away with. What we want is the adoption of more prompt, direct unequivocal action in criminal cases. (J. W. Monroe, Sheriff, Yolo County.)

Improvement of administration of criminal justice: (1) Further study of the possibilities through amending the Code of Criminal Procedure to the end that final judgment in criminal cases be reduced to the shortest possible time without impairing justice. Speedy final judgment is more to be desired than heavier penalties. (2) A study of the age of judges in the Superior, Appellate and Supreme Courts of California. A survey would show, probably, that due to the advanced age of many of these judges, and their consequent inability to devote the time to their work that would be possible for younger men, there follows delay and congestion. Possible recommendations that age limits be fixed for all judges; that is, that none be appointed or elected beyond a certain age limit, and that after a certain age is reached after a certain number of years of service they be retired with a measure of compensation. The whole idea is to bring vigor to the bench that would result in a speedier determination of cases, both criminal and civil. (C. H. Deuel, Assemblyman.)

From my experience in handling criminal matters, my first suggestion would be that more prompt handling of all criminal matters brought before our courts is absolutely necessary. I have observed that delay in many of our cases has been the direct cause of letting criminals escape, and in addition it has bred perjury and dishonesty in the efforts which are always made in behalf of the defendants. I have observed that there is a certain type of practicing attorney who relies entirely upon the fixing of witnesses, getting witnesses out of the state, and framing up evidence, and all of this goes of course to create criminals rather than to prevent crimes. * * * and I firmly believe that the more definite and more speedy handling of matters brought before the courts would do more to prevent crime than perhaps anything else. (C. W. Mathews, Chief Probation Officer, Riverside.)

It has seemed to me, however, that one of the most serious difficulties is the delay in the trial and conviction of criminals. If we could handle such matters as promptly as I believe they could be handled I feel that the result would be an improvement on present conditions. (Barton Warren Evermann, Director, California Academy of Sciences.)

I simply wish to state at this time that in my opinion one of the most necessary things in connection with handling of criminal cases to reduce crime, is to bring about the administration of justice as quickly and surely as it can possibly be done. I believe the technicalities that have been worked up throughout the years in our criminal courts, causing unnecessary delays from beginning to end in the handling of criminal cases is in itself one of the outstanding crimes in our country.

It is true that it helps to make large fees for attorneys and others interested, but it certainly is not in the interest of justice. I believe that it is the certainty and the quickness with which punishment is meted out to criminals that counts more strongly even than the amount of the punishment itself. If criminals were given to understand that they are likely to be apprehended, and when apprehended, that they will be brought to trial immediately, it will soon cause them to think that crime is not a paying business. All technicalities should be absolutely swept away in the courts, and everything arranged to bring about substantial justice with the least possible delay. This would not only serve to lessen crime in my opinion, to a very great extent, but it would also lessen exceedingly the cost to take care of the criminals over the country. (M. B. Johnson, State Senator.)

If there is anyway under Heaven to do so, speed up the courts. There are too many delays; too many new trials; too long an interval between the commission of crime and bringing the defendant to trial. The handling of the defendants in any trial, contrasted with the procedure that exists in England, for example, today, is so marked in this respect as to make further comment unnecessary. (David Martin, Superintendent of Schools, Alameda County.)

The judicial department should get to work, and dispose of the cases speedily. Many cases that should take but a single day to try, are strung out and out and out, until the people become disinterested in the conviction of any alleged criminal. This cannot be controlled by statute, but must be brought about by cooperation of the judicial department. A grave mistake would be made if speed were exerted simply to satisfy public clamor. Speed in trials should be exerted solely to bring about justice at an early date. Prompt justice is quite as important as exact justice. Just as speed is brought about so much, and more, should the judicial department exert every effort that a correct decision should be made. (Ernest Weyand, Superior Judge, Colusa County.)

I believe that two essentials in the administering of justice are speed of trial and certainty of punishment. Any arrangement which will improve the situation

in these two respects will perhaps help our situation. (Walter R. Hepner, Superintendent of Schools, Fresno.)

COURT PROCEDURE

Our judicial system is not a good instrumentality for ascertaining the guilt or innocence of a person charged with crime. It is a modification of the primitive wager of battle with hired substitutes to do the fighting and an umpire. The proceeding is clumsy, costly, slow and the results dubious.

The proceedings should be of the nature of a judicial inquiry rather than a cause of action, and the judge should take the initiative in doing the inquiring and in selecting the jury, giving counsel opportunity to be heard under proper circumstances.

Our system harks back to a time when privilege occupied the seats of the mighty and the oppression of the common man was the end and aim of the social order. The old social order has long since disappeared, but the judicial system applicable to it still remains to plague us.

Under the old system "true bills" could only be found by grand juries and persons charged with the commission of crimes, were, in law, presumed to be innocent until proven guilty. Grand juries, still surviving, are as useless as the vermiform appendix, and when a person is arrested and charged with crime the real presumption is that he is guilty. The accused should be made to account for himself, not in a "kangaroo" court, or have the truth sweated out of him in his cell, at dead of night, distraut for want of sleep and badgered beyond human endurance, but openly in court in the presence of the state attorney and his own and under the control of the court. It is the truth that is wanted and that is the way to get it. (A. J. Pillsbury, Berkeley.)

Owing to the complex civilization of the present age, the settling in great centers of population, the speed of transportation, the great wealth of the criminal classes generally, and the political pull which is being exercised by crooked politicians and criminal syndicates, it is very difficult to apprehend the present day criminal. I understand that there is a very small per cent of criminals apprehended, possibly not more than five per cent. The twenty to one chance of not being caught may be figured on in the first place by the criminal. If apprehended, the work of the criminal lawyer begins, and the crooked politician, the sob sisters, probation officers and social workers generally take up the work. There is delay, and in many cases dismissals, meting out of inadequate punishment and often no punishment at all—simply probation—which in my judgment is not much better than a slap on the wrist and has very little effect upon criminals of the class of felons, and of course probation does not operate except in that class of cases or at least in indictable misdemeanors and felonies. I understand that the records of California today will show that probation is granted to from 50 per cent to 75 per cent of this class of cases.

It is my personal opinion that probation and the probation officers (who are no doubt conscientious and honest in their purpose, but have the angle of the criminal and his family rather than the interest of the public at heart) are responsible for a great deal of the prevalence of crime.

The last legislature performed a great public service in simplifying criminal procedure, in prescribing methods for accomplishing justice rather than for obstructing it and freeing the criminal, but I feel that there is a great deal to be done yet before we shall have anything like speedy, certain and adequate justice. (James C. Byers, Sheriff, San Diego County.)

Elimination of the archaic system of preliminary examination. This is so unsound that it is needless for me to discuss the question further. The criminal bail bond broker, the professional alibi witness and perjurer, and the shyster attorney would disappear if preliminary examinations were made unnecessary. (August Vollmer, Chief of Police, Berkeley.)

I would suggest that legislation be passed insuring the immediate disposition of criminal cases on appeal, either by existing courts, or by creating additional courts for such purpose. Under our present procedure there is no great delay in the trial of criminal cases, but necessarily some months are taken on appeals. Something similar to the English procedure, I believe, will be preferable so that criminal cases are disposed of by courts of last resort within a short time after the trial. This would operate both as a protection to the innocent and as a prompt punishment of the guilty, and would thus help to reduce crime. (Victor R. McLucas, Judge of Superior Court, Los Angeles.)

The second suggestion I would make is that criminal cases be speeded up and tried at the earliest possible moment after the commission of the crime. The last legislature made an excellent step in that direction but there are many ways in which the system could still be improved in that regard. (L. Gibson, District Attorney, Mendocino County.)

We think also that on habeas corpus proceedings which involve a construction of a statute, and which are originally decided in the District Court of Appeal, that there should be a right to have the legal question reviewed by the Supreme Court. There seems to be no such right, and especially where the decision is against the contention of the people. (Carl Barnard, District Attorney, Sonoma County.)

It had been my impression that nearly every appeal in criminal cases was unwarranted because nearly every case is affirmed. Recently I received a copy of the report of Hon. U. S. Webb as Attorney General. I turned to the facts therein stated regarding criminal appeals. My former impression was reinforced. I am inclined to the opinion that much would be accomplished by an amendment of the statute which would place the power in the Supreme Court or the Chief Justice to say when an appeal might be taken, or a writ of error or writ of review issued. (Geo. A. Sturtevant, Associate Justice, District Court of Appeal.)

The proportion of criminals that are caught and get as far as the trial is said to be about two or three in a hundred. Obviously, not much effect can be produced permanently by speeding up the trial and increasing the punishment of the two or three who are caught. The whole criminal procedure from arrest to execution must be studied and not merely the comparatively insignificant segment relating to the trial. (A. M. Kidd, Professor of Law, University of California.)

Continuation of efforts to shorten time between offense and punishment. (Joseph Koford, Presiding Justice, District Court of Appeal.)

In the next place, there will be little improvement until the people decree, not by law alone, but by a mightly moral purpose and determination, that legal technicalities, silly, sentimental interpositions, and findings of fakir psychiatrists and alienists, shall be swept away and that nothing shall come between any criminal and the partaking of the fruits of his crime, because the protection of society requires that it be relieved of the unequal struggle with criminals. (Susan M. Dorsey, Superintendent of Schools, Los Angeles.)

DISTRICT ATTORNEY

I think one of the most important things is to amend the law so that no district attorney or deputy district attorney, or attorney general or regular deputy, or any other regular attorney in the service of California or any of the counties or large cities, can have a private practice. My observation teaches me that the influence of private clients upon lawyers engaged in public service is frequently bad. This change might necessitate the giving of the district attorney more than one county to handle, in the case of a small county, but it would prevent prospective violators of the law from hiring an attorney who is supposed to be in public service by giving him a regular monthly or annual retainer. Of course there are some men who are too upright to be influenced by this procedure consciously, but I think the best of them are liable to be influenced unconsciously in favor of the man who is paying them substantial sums of money.

While I have always been a strong advocate for local self-government and am not yet sure that I would depart from this principle in this connection, but of late years I have been wondering if more of an interchangeable system for prosecuting officers would not be advisable or possibly a system whereby there would be deputies in the Attorney General's office subject to assignment in different counties and cities under such a system that they would work independently of the local district attorney. A district attorney is only human and even though he is a good man he is naturally inclined to believe his friends in preference to others and if he is chiefly a politician this characteristic is liable to become dangerous to the well-being of his community. (Roscoe J. Anderson, Assemblyman.)

EDUCATIONAL PROGRAM

An education program fostered by the Crime Commission should prove effective. If we are to effectively curb crime the general public must be awakened to the situation and put in a frame of mind to properly support reform movements needed to improve conditions. Research studies in the causes of crime and methods of

treatment of criminals should prove beneficial. The State University might be utilized to promote research in this field.

A simple campaign of education through the press and over the radio, urging automobile owners to lock their machines when parking them would reduce the amount of automobile thefts. Approximately thirty-five per cent of the boys of the Preston School of Industry have been committed on charge of auto theft. The boys found most of the cars unlocked or with defective locking devices which were easily tampered. (O. H. Close, Supt. of Preston School of Inudstry.)

Summing up my feeling in the matter, I would say that every possible measure should be taken to educate the people of the state generally in the matter of proper training of the young people in the homes and in the churches; that every encouragement be given to the great welfare agencies who are training and supervising the play and activities of the younger generation; that playgrounds and parks be encouraged so that every opportunity may be given to the boys and girls of our commonwealth to become honest, upright and law abiding citizens. But in all cases where punishment is necessary, that justice be administered with speed and certainty, and that the punishment meted out shall be adequate, as a preventive measure. (James C. Byers, Sheriff, San Diego County.)

Appoint one or more state criminologists to go about the state and assist in coordinating the activities of the various communities' social agences. To illustrate: The state officer should enter the city of Berkeley and induce the chief of police, superintendent of schools, director of public welfare, health officer, and other agencies interested in the welfare of children to effect a permanent organization which would meet weekly and have for its purpose the study of problem children and the elimination of the causes of delinquency. (August Vollmer, Berkeley.)

There should be a systematic campaign carried on to acquaint people everywhere with the reason why certain things are wrong, and with the nature of the punishment for those wrongs, and with the assurance of the punishment. Many people believe that bootlegging is a legitimate industry comparable to the grocery business, but more hazardous. That type of notion with respect to bootlegging, which is a wrong idea, is due to the fact that there is a great lack of proper instruction in regard to the laws made for the enforcement of the eighteenth amendment. (Mark Keppel, Superintendent of Schools, Los Angeles County.)

EVIDENCE. COMMENT ON BY COURT.

I would say that a measure which would permit the superior judge to comment freely upon all evidence and questions of fact before the jury would be exceedingly wholesome and effective. * * * And I further believe that a statute permitting prosecuting officers to comment on the fact that the defendant does not take the stand would be wholly just if counterbalanced by a statute as suggested before which would permit the judge to freely comment on the evidence. (G. C. Darrah, District Attorney, Stockton.)

The real trouble comes in the attitude of the juries who are unwilling to convict. In our opinion, the most efficient method of overcoming this condition is to amend the constitution so as to permit judges to comment upon the evidence and to permit juries, at least where the death sentence is not involved, to bring in a verdict upon the agreement of nine jurors. (Carl Barnard, District Attorney, Sonoma County.)

I also believe that the constitution should be so amended if necessary, permitting judges in criminal cases to comment on the facts and weight of the evidence. I realize that in some instances that power might be abused, but such abuse would certainly be corrected, either by the judge, himself, granting a new trial, or by reversal of the case, and new trial granted on appeal. On the other hand, the judge would realize such power being granted, that power must be used with care and fairness, and with careful and full instruction to the jury that notwithstanding the comments of the court, the jury were still the sole judges of the facts, the weight of the evidence, and the credibility of the witnesses. (J. A. Allen, Judge, Superior Court, Tulare.)

Restriction of false issues in jury trials. The greatest step in this direction would be accomplished by allowing the trial judge to comment to the jury upon the evidence and its weight in an advisory capacity. (Judge Koford, Presiding Justice, District Court of Appeals.)

FIREARMS

There is no question but what the California Gun Law is the best gun law in the United States. The International Association of Chiefs of Police endorsed the law with the recommendation that it be written into the statutes of the different states

of the Union. It reaches aliens and persons convicted of certain felonies by absolute prohibition. The courts, however, deem the matter of carrying concealed firearms rather lightly and impose either minimum fines or the minimum punishment. (D. Mathison, Captain of Detectives, San Francisco.)

The section of the law appertaining to the reports of sales should be changed to provide for the filing of a duplicate copy of the report in this office, where the reports should be available at all times. (C. S. Morrill, Superintendent California State Bureau of Criminal Identification and Investigation.)

Citizens should be required by the government to give up all revolvers and pistols. Such firearms should be in the custody of peace officers only. Citizens should be allowed shotguns and rifles for protection and hunting purposes. You and I and other peaceful citizens do not go forth with revolvers in our pockets. It is the robber, the holdup man and the murderers that carry concealed weapons. (E. J. Fitzgerald, Superintendent of Schools, El Dorado County.)

INTERMEDIATE PENAL INSTITUTION

A modern reformatory should be established to care for first-time offenders between the ages of 21 and 30, and for such cases between the ages of 18 and 21 that are undesirable for the Preston School of Industry. (O. K. Close, Superintendent, Preston School of Industry.)

An intermediate institution between the Preston School of Industry and San Quentin, to which might be committed young men, say from 18 to 30 years of age, first offenders, who are beyond the corrective influence of such an institution as the Preston School, but who are not yet at a point where they should be subjected to the association of the average run of the men in the state prison. (K. J. Scudder, Superintendent, Whittier State School.)

From my experience in this city, which has not been particularly extensive, I feel that one of the most important things for the State of California to do at the present time is to establish additional institutions for the care and correction of juveniles. Time after time we have juvenile cases that can not be removed from their bad environment until their anti-social proclivities are developed to such an extent that it is very difficult to correct their habits. (H. A. Zink, Chief of Police, Palo Alto.)

If we are genuinely in earnest in our efforts at reformation as to the first offender, we ought to have a penal institution for first offenders with only sufficient supervision that will restrain the inmates, with an abundance of vocational work with agricultural pursuits at the head, a place of confinement where these youngsters may work out their own moral salvation, under a just, practical and humane supervision.

I am convinced that the long adopted theory of nonpunishment of first offenders has been totally wrong. These first offenses should be and ought, I think, be punished. The punishment should be certain, with little or no opportunity for probation until the inmate has deserved probation by his conduct after conviction.

The very fact that the first offender realizes both before and after he has committed his first offense, that he will be dealt with very leniently, causes that individual to be careless in his conduct, and he will easily and willingly take chances of committing crime, realizing that his youth and his first offense will save him from any severe punishment. I may add that for a period of ten years or more upon the bench, I have religiously followed the theory, that the first offender could and would be helped to change his attitude of mind from that of a criminal bent towards a law abiding and moral life. I am quite confident now that this has been a wrong and harmful theory, as my experience shows conclusively that most all offenders, from 19 to 30 years of age, who were treated as first offenders, and granted probation, have not been helped, but upon the contrary, have become confirmed criminals. (Wm. H. Ellis, Judge of the Superior Court, Riverside.)

Our reform schools should be graded. As it is now all types are placed together. The fiction of age which allows grown men to be placed with young boys in reform schools should be done away with. I mean by grading that there should be some schools for very young offenders, others for more serious cases, and so on down the line, and that there should be a very careful study by properly trained people as to the mental condition of criminal attitudes in placing law-breakers in these schools. Our public schools are caring for many boys and girls for whom it would be ruinous to send to our present reform schools, who undoubtedly would be corrected and set right if properly handled before they break out. (Chas. C. Hughes, Superintendent of Schools, Sacramento.)

The first suggestion I have to make in the matter of reducing crime in California is the repeal of the "Indeterminate Sentence Law." My experience has led me to believe that this is the strongest ally of the criminal in California today. Let the judge who has heard all the evidence, seen the prisoner and observed his conduct, and who knows all surrounding circumstances, fix the minimum penalty. This is not only justice. It is common sense. (Judge Tuttle, Superior Judge, Nevada County.)

The greatest curse to the state at this time is the indeterminate sentence law. As long as the law admits the criminal to parole under the present system our state will be a mecca for such persons. I am of the firm belief that if the indeterminate sentence law was repealed and the trial judge given the authority to pronounce the sentence to be served, with assurance of its service, crime would decrease. (James L. Allen, Superior Judge, Santa Ana.)

JURY AND JURORS

Amend the state constitution so that three-fourths of the jury could return a verdict of guilty in all cases involving a misdemeanor or a felony, except where the punishment is death or life imprisonment. It seems almost impossible to procure a unanimous verdict of guilty in many cases where the evidence is clear and convincing because of the bias or prejudice of some juror. I am absolutely certain that we have had hung juries in this country because some member of the jury was opposed to the district attorney's office from a political viewpoint. This may seem almost impossible, but it is a fact nevertheless. (Elmer W. Heald, District Attorney, Imperial County.)

I think that the failure of the courts can be traced, in most cases, to our jury system. I suppose I am guilty of near treason for my views, but would like to see juries abolished. I quite realize that such a thing is out of the question, but I do believe that the time is ripe to do away with the absurdity of demanding a 100 per cent agreement in criminal cases. (R. F. Fisher, Assemblyman, Carlotta.)

First, we need to simplify our instructions to juries, and fix it so we need not fear reversals if requested instructions are not given, provided simple and understandable instructions are given defining the crime, degrees, etc., with a minimum of general instructions. I find these confuse good jurors, and tend to make them think they are being required to change the ordinary workings of their minds, into some technical legal points of view, which they are unable to follow, and which results in honest and well meaning jurors being misled into efforts to be technical, with wrong results.

Second, and above all, we need to provide for a conviction on a vote of three-fourths of the jury, or at least less than twelve. Justice frequently miscarries through one obstinate, prejudiced or dishonest juror. (Chas. R. Barnard, Judge of Superior Court, Fresno.)

I feel that a three-fourths verdict by a jury in misdemeanors not indictable would be of advantage. (James A. Nutting, District Attorney, Lassen County.)

I believe that in most of our counties, the jurors are selected as in Kern County: that is, by the names being selected by the board of supervisors. We find that each member of the board submits 150 names, giving the names of those who ask to be placed on the list and omitting those who have asked to be excused from jury duty. The large number of names are selected at random from the voters list of each supervisorial district. In this way, we sometimes get jurors of poor standing in the community and incidentally sometimes those who are blind or deaf and dumb and in other respects totally incompetent to serve as jurors.

Inasmuch as the purpose of all our recent legislation seems to be to make punishment more certain in order to reduce crime in California, I think we should be more careful in the selection of those upon whom the burden is placed to ultimately enforce the law. My idea in amending this section is to provide for the selecting of trial jurors by the clerk of the superior court under the immediate supervision of the judge or judges thereof. In this way we can obtain jurors of a much higher character and thus eliminate the element of politics as practiced under the present system. (Ray Bailey, District Attorney, Kern County.)

Do away with the jury system entirely and leave the matter of administration of criminal law up to a judge or three judges. This, of course, will never come to pass during our time but I am satisfied if this were done the commission of crime in California would be cut in half within thirty days. So long as those cases must be tried before a jury, the rule should be the same in a criminal case as in a civil case and

nine of the twelve should be able to render a verdict. This in itself would be a tremendous improvement upon the present system and would do away with a lot of the evils we have now to contend with. (Lilburn Gibson, District Attorney, Mendocino County.)

An amendment to the laws relating to the exemptions of jurors to the end that a large number of very valuable citizens who are excused from jury duty, may be compelled to serve. In other words at this time a great many men of wide business experience and judgment never serve upon juries because the laws are so lax as to exemptions that they forget their duties as citizens and are excused from performing their duty. (H. D. Burroughs, Superior Judge, Lassen County.)

The 1927 legislature gave us a good system of criminal procedure, but we still have with us the jury that disagrees in spite of clear and convincing testimony. This is especially true in misdemeanor cases. I have talked with obstinate jurors who have told me that the defendant was guilty, but he was afraid the judge would impose excessive punishment, and for that reason the juror did not vote for a verdict of guilty. Many times I have seen juries come from the jury room and ask the judge what the punishment would be, in case of guilt. It does no good to tell the jurors that they must not consider the question of punishment in arriving at their verdict, for they will consciously or unconsciously ignore such an instruction. For that reason I would suggest that the law be changed so as to allow the court to advise the juries of the maximum and minimum punishment allowed by law in misdemeanor cases, and then let the juries fix the punishment. (Mason Bailey, District Attorney, Madera County.)

My suggestion to improve administration of California justice and reduce crime in California, is to adopt either a five-sixths, or three-fourths jury verdict necessary for conviction. This would prevent some individual person, through malice, ill will, corruption or otherwise, from defeating justice, either on the part of the prosecution or the defense. If it should be deemed necessary that twelve people should concur in the person's guilt, then this could be met by having fifteen jurors with twelve necessary for conviction, which would be a four-fifths verdict, or, the concurrence of twelve persons. (Jess Hession, District Attorney, Inyo County.)

JUVENILE DELINQUENCY

My own personal opinion is that the present crime wave as it is generally referred to is to a large extent due to the lack of parental control of children and the breaking down of the home ties. I am of the opinion also that there has never been a time in the history of the world when young people were subject to as many temptations as today, and yet the influence of the home is constantly declining. Practically all of the social activities of the younger generation are outside of the home, without any proper supervision or restraint. We are living at a tremendous pace and in an age of luxury, which is turning the heads of the older people and having its influence, of course, upon the younger generation.

Another cause of juvenile delinquency and astounding criminal situation with respect to the young men and boys of this age in my judgment is the lack of religious training. So far as I have been able to discover there is no institution other than the church which can and does inculcate the moral virtues and fundamental principles of right living; and still attendance at our churches and religious meetings is declining to an alarming extent. The young people are not associating themselves with the Sunday schools and churches as in the previous generations, and many of our churches are at the point of closing their doors. I feel that we need a revaluation of religion, but I do not see how either of these remedies can be applied by any other means than education of the people generally. It is more important to start the young people out on the right track than to attempt to reform them after they have gone wrong. (James C. Byers, Sheriff, San Diego County.)

I further believe in the strictest and most rigid surveillance of pool rooms and places where young men are inclined to congregate. In such places they become loose in their habits, lose respect, absorb a gambling instinct, and while there is nothing really criminal about such things, nevertheless through adverse circumstances resulting from gambling at such places or loss of time, hence loss of earnings, on account of time spent at such places, they may easily be encouraged by force of sheer circumstances to commit their first crime, slight though it may be, but attractive and leading to worse offenses. (Peter O'Brien, Chief of Police, San Rafael.)

Of course, we all know that Young America is being neglected in the homes today: the youngsters are looking for thrills; if they do not find them in one direction they

seek another, and may not always stop at the danger line. It has been suggested that the school term should be lengthened; that some methods should be found to occupy the youngsters during vacations; in rural communities work is found, but in cities like Pomona, for instance, it is different, and one great problem is what to do with the youngster during vacation. The average boy or girl is full of pep, and if they have nothing to do, they are likely to get off on the wrong foot. Most of our criminals are young boys. Are we on the right track in sending them to the pen. for their first mistake? Would it not be better to have some institution where an effort could be made to give them another chance, and not throw them in with hardened criminals? (Cadet Taylor, State Senator.)

In my opinion the two principal causes for juvenile delinquency have been caused by legislation along labor lines and school laws. Both of these forces are now so well established that it would take courage to try to take away any of their powers. Union labor restrictions placed on the number of apprentices, have kept many boys from learning useful trades; have forced many into occupations that are not congenial and robbed them of the feeling of self dependence that is the foundation of good citizenship.

Boys from grammar school are forced to pass several years in high school regardless of their inclinations or ability. Those that may have made good craftsmen, and not scholars, have been imbued with ideas that conflict with the opportunities offered them after the school is finished. The result, in most cases, is to turn out a high grade of servants for corporations, or failing to secure a position, a lot of boys with high ideas and no jobs, dependent on a father who may be a section man.

But the main thing that caused juvenile delinquency is the lack of opportunity our boys have to develop initiative. Things are made too easy for them during the time they attend school, and then they are thrown out in the world without means of or qualities to live on. Their ambition has been quenched to an extent, and, having been used to the comforts of life, still crave them and will not give them up. (James L. Richarson, Probation Officer, Shasta County.)

LAW ENFORCEMENT

Enforce the law as written; confine compromises to such cases as are provided for in sections 1377-1379, Penal Code. Do not encourage district attorneys, justices of the peace and officers of the peace to judge as to the merits of the law. A strict enforcement of an objectionable law will lead to its abolishment. (W. W. Sublett, Sheriff of Shasta County.)

MARRIAGE AND DIVORCE

In a small community where one has the opportunity to know the entire population, to see the growth, development of the individual, perceive his and her defects physically and mentally, and finally to hear of the union of two unfit people to see brought into the world a child that will develop into another charge upon society; to me here is the start, the groundwork for an improvement in economic conditions, to say nothing at all of all the other phases of social welfare. (W. C. Rhodes, Sheriff of Madera County.)

People marry today through the medium of mere fancy or sexual gratification, without serious consideration and respect for the marriage vow; and children are born without any preparation on the part of the parents to receive them or care for them; and children do not enter into the daily program of the home.

That the youth of today is considered of little importance, and is not trusted or allowed to perform those duties, where such duties require those performing them to be competent, responsible and trustworthy. We are convinced that we are in need of legislation that will help to establish homes, in the full sense of its meaning and that there should be proper evidence submitted to establish the justice of the marriage—that those marrying should be mentally, morally and physically fit. (W. B. Young, Probation Officer, San Joaquin County.)

MOTION PICTURES AND NEWSPAPERS

The fault is not in the laws or the judges, but in my opinion the fact that newspapers are constantly making heroes of all criminals in major crimes, playing them up on the front page head lines; this appeals to the young boys, and I believe is the forerunner of many crimes. Also the moving picture plays are featuring gun-play in many productions, and the boy leaves the picture show with a hankering

to be a hero, and all that is left for him to do is to purchase a gun and start on the road to banditry. Boys of this day and age do not have the opportunity to extend themselves by hunting and roaming the wilds as could have been twenty years ago, owing to the encroachment of civilization, and the boy naturally is looking for excitement and with the above encouragement of picture shows and newspapers he is led astray. (J. V. Henry, Chief of Police, Redondo Beach.)

These deteriorating influences are: the daily "funny sheet," the serial stories in the newspapers, and the general type of moving picture shows. There should be a law against admitting children under a certain age to certain picture shows. (Minnie M. Gray, Sutter County Superintendent of Schools.)

I think the glorification of crime and misconduct has gone too far. The practice of the press in referring to the despoilers of humans as, "Beautiful love bandits," and of referring to those who hold up banks, filling stations, drug stores, etc., as, "Beautiful bandit queens," and similar high-sounding words and phrases used to described cheap, tawdry, practically worthless bums, thieves, cut-throats, murderers, is a practice which is growing and which throws a glamour of romance and charm around crime, which misleads our immature boys and girls. (Mark Keppel, Superintendent of Schools, Los Angeles.)

PAROLE

The methods of parole and parole supervision from penal and correctional institutions are in need of careful study and revision. At the present time parole methods are entirely too mechanical. Parole from penal and correctional institutions should follow a careful study of each individual case by persons competent to pass upon the individual's fitness to return to society. The length of stay in the institution should not be the determining factor. Many psychopathic criminals that are now released on parole from prisons and reformatories should be retained indefinitely. Probably more careful segregation of various types of prisoners is necessary before scientific parole and parole supervision can be accomplished. (O. H. Close, Superintendent of Preston School of Industry.)

The parole system is good but paroles are now issued, in a great many cases, because of the overcrowded conditions of our state prisons and reformatories. (J. C. Baldwin, Chief of Police, Marysville.)

More severe sentences on proven crimes and abolishing to a certain extent the present parole system in regards to hardened criminals, as the hardened criminal when paroled will not obtain work owing to the existing conditions of employment and having heard and seen nothing but arguments on this subject for some time, will slip into the same old rut, even at times resorting to gun play to obtain his desires, under extenuating conditions the parole of the previously termed convict is justified, but only in rare cases. (R. L. Hastings, Chief of Police, Watsonville.)

A defendant convicted in a criminal case does not expect to spend a very considerable part of his sentence in a penal institution, and in the past many have been released upon parole, that have proven themselves both before and after sentence hardened criminals. I believe that the trial judge should have a voice in fixing the sentence of the defendant and fixing the actual time which he must serve, and also should be required to pass upon the paroles of those whom he has sentenced to the penitentiary. (E. J. Marks, Superior Judge, Orange County.)

I feel that it would be useless to improve our administration of criminal justice, until our parole system is changed. Our laws are all right, and are justly administered, but to my opinion there is too much influence and pressure brought to bear upon our officers and courts, towards getting a man on probation who has been convicted of a crime. In many cases, I contend that if a man knew, before committing some nature of crime, that he would absolutely be sent to prison, if convicted, that he would hesitate before committing any offense against the laws of our country. (L. C. Rogers, Chief of Police, Santa Ana.)

Another suggestion would be that our parole system is overworked and to a great extent is a farce. We are constantly being brought face to face with its failure in many cases. My experience also has taught me that our state institutions are overcrowded and parole is given many times more to make room for new inmates than the merit of the case would warrant. This is positively true of the parole system of the Preston School of Industry. The Whittier State School is also crowded and a waiting list exists at all times. (C. W. Mathews, Chief Probation Officer, Riverside.)

The parole board at the state prison should be composed of the warden and five other representatives of the different sheriff and police departments throughout the state, who are trained in the handling of criminals and knew their habits thoroughly and are not easily influenced by sentimental people who believe that everybody should be released immediately after entering prison. For instance, the warden could be chairman and the following appointed as members: Chief of Detectives of San Francisco, Sheriff of San Diego, Chief of Detectives of Los Angeles, Chief of Police of Fresno and the Sheriff of Sacramento county, or any such line-up from whatever part of the State thought best, in order to identify and properly handle criminals from whatever county they might come. This system of handling criminals has a very great tendency to discourage law enforcement officers and make them really believe that their efforts are not appreciated. Crime has doubled, tripled and quadrupled under this system of lenient handling of criminals during the last twenty-five years despite the fact that we now have the best organized, most intelligent and efficient social service agencies, the most efficient and best organized school attendance agencies, the best organized and most efficient probation departments, the best organized and most efficient police departments and sheriff departments, the best criminal judges and the most efficient prosecutors that we have ever had in the history of the country.

You are perhaps aware that the state prison boards throughout the country have, in most cases, made the minimum sentence the maximum which the prisoner is compelled to serve, either legally or otherwise, as the case may suit their sentimental whims. Most of the state prison boards throughout the United States are honest and splendid men and capable of handling the institutions from an economic standpoint but are totally unfit from training or experience to judge dangerous criminals and intelligently fix the length of their terms in prison. There are many men of this class who are strictly honest and could not be approached from a monetary standpoint, but there is not a man holding this position in the United States who can not be reached from sympathy and influence, and this is being done every day. (C. H. Kelley, Chief of Police, Pasadena.)

The matter of parole from prison, particularly the case with which parole is obtained and which leads the criminal to feel that it is a good gamble whether or not he will be punished, is a matter which should be also, in my opinion, taken into consideration. I know as one who has intimately handled hundreds, if not thousands, of adolescents that the feeling is entirely too prevalent that they will take a chance—they may not be caught, if they are the punishment will be mild or they will be placed on parole and given another chance. (David E. Martin, Superintendent of Schools, Alameda County.)

California has an extensive parole system. I believe in the parole system. I am sure that it has done a great good, and that to abandon it would be to drop at least a thousand years in human progress. To my way of thinking, we need to improve the parole system. To put the highest type of men and women in charge of it. To pay them adequately, and to hold them to a very high standard in the performance of their official duties. Society can not escape its share of blame in the murder of Marion Parker. If a proper record and comparison of the finger prints of the paroled Hickman had been made, he would never have had opportunity to murder Marion Parker. Our parole system, our probation system, should be so highly developed that whenever a boy or a girl, a man or a woman is put on probation and given parole, the authorities shall have his complete crime history at their disposal and shall know exactly what type of wrongdoer is being sent out on parole. Society can not afford to spend millions of dollars in an attempt to abate crime and then put criminals into the hands of men and women who are not of the highest type. (Mark Keppel, Superintendent of Schools, Los Angeles.)

While 1707 prisoners were paroled during the biennium ending June 30, 1926, new crimes were committed by 218 paroled persons. They may not all have been out of the particular 1707 so paroled. Anyhow as a generalization, 218 prisoners were paroled out that should not have been; 12.77 per cent of mistakes made. That is not a record for the State Board of Prison Directors to be proud of. (A. J. Pillsbury, Berkeley.)

The history of crime today is briefly this: The criminal is probationed first; then another outbreak of his criminal propensities calls for trial and the carrying of the case to the various courts; finally he is sent to jail, or possibly to prison, perhaps for life; then there must be resistance to prison riots in which he participates, or pursuit of him when he escapes; finally comes a parole and the criminal is at large to begin all over again the enacting of his drama of crime. To sum up, the trial of any criminal should be speedy, conviction inevitable, sentence unescapable, with no

parole, and all this for just one purpose, the protection of society. Which is more valuable, society or the criminal? (Susan Dorsey, Superintendent of Schools, Los Angeles.)

PERJURY

Perjury is all too common, and is practiced by defendants and witnesses. Convictions for this offense are most difficult to secure. If some means could be devised to give judges more summary powers to deal with this, at least to the extent of placing them in jail or on heavy bail until actions could be started, the practice might be lessened. (Chas. R. Barnard, Superior Judge, Fresno County.)

POLICEMEN

Entrance requirements for police officers should be raised. In other words, the intelligence, character, and training for policemen should be much higher than the accepted standards of today. No person should be permitted to exercise the function of police officer until he has had at least one year's training in a recruit school. (August Vollmer, Chief of Police, Berkeley.)

For this army of half million engaged in crime prevention, detection, and treatment, there is no professional training worthy of the name. The police in particular are selected from grammar grades and dependent for their officers almost entirely upon development from within. Imagine the army without its West Point, the navy without its Annapolis. Imagine either without the additional material drawn from the universities and colleges and normal schools. Imagine any well developed business without its nucleus of men trained in liberal arts, technology, and business administration. (A. M. Kidd, Professor of Law, University of California.)

The organization and equipment of our police departments have not kept pace with the increased speed and stimulation of modern society. There should be a careful study of the whole situation and a careful determination of the character of intellect and physique and moral outlook required in a police officer, the improvement of the morals of the personnel of existing police forces, and all modern equipment that would expedite the detection and capture of criminals should be furnished. (Susan M. Dorsey, Superintendent of Schools, Los Angeles.)

POLICE COURTS

A great difficulty at the present time lies in the police courts. A police officer is unwilling to make an arrest except in a very flagrant case for the reason that he will probably be called on to attend court day after day and at last to find the case dismissed. After a few experiences of this kind, an officer is not likely to be very efficient in enforcing obedience to law. A cursory review of the disposition of arrests made shows that over eighty per cent are turned loose without penalty. In practically every one of these cases an offense has been committed, possibly a trivial one, frequently a serious one, and yet no punishment is exacted. We could hardly think of a better system for the development of a criminal class and the encouragement of their activities. Between the indisposition of the police to arrest and the refusal of the police courts to sustain the arresting officer, the chances are vastly in favor of the offender. (E. A. Walcott, Executive Secretary, Commonwealth Club.)

POLICE ORGANIZATION

Provision should be made to separate the duties assigned to heads of large police organizations. The police organization as such, should not be required to give attention to vice or traffic problems. A separate confession for traffic and still another for vice should be organized, and the men selected to perform the duties of traffic officers or vice-control officers should have nothing to do with other police matters. I shall not dwell upon the reasons for this separation of duties at this time; they must be apparent, however, to every man who has observed the failure of large police departments to function efficiently in communities they serve. Police commissions, public safety commissioners, and other uninformed individuals or groups should be eliminated and the responsibility of control of the department placed upon a single trained police official, namely a commissioner with large police experience, who would be directly responsible to the mayor or city manager. In some of our cities the chief of police will take the place of a commissioner. (August Vollmer, Chief of Police, Berkeley.)

In European countries there is a ministry of justice with considerable powers of control over the entire army engaged in the war against crime. In this country

most officials are elected and responsible to no one. There is no way of compelling police, sheriffs, magistrates, district attorneys, judges of general jurisdiction, judges of appellate jurisdiction, clerks, prison officials, to act together. Very often they are actively hostile to each other; but even where not, there is a lack of coordination which prevents effective action. If any of the various officials fail to function from inadequate equipment, laziness, corruption, or any other reason, the prosecution fails and the work of all the others goes for nothing. The decentralization is likewise geographical. Each state operates with entire independence of every other and with only accidental or casual cooperation. Yet crime in many of its aspects is national and even international. (A. M. Kidd, Professor of Law, University of California.)

Then we have a constantly increasing lack of unity of cooperation, between national, state, county, and city police. As a consequence we have a failure to enforce laws. Where discord exists in the enforcement department, the criminal element can take advantage of that situation. In any one given territory the police department should be unified to the highest standard of efficiency. Police officers from a foreign source or department, are frequently sent into a locality, and make investigations or arrests, in the face of local officials, and such action quite often receives the open criticism or disapproval of local officials. Wherever it is possible, local officials should be entrusted with the enforcement of any of the laws. There should be no "special" enforcement of given law. Any and all penal laws should be enforced in the same manner. No one law should be given any manner of special attention. Enforcing one law, and permitting the commission of another kind of offense, begets a kind of "see saw" as it were. One body or element of the people naturally say, "If you allow gambling, why not the sale of illicit liquor"? Nothing can be more injurious to the whole matter of enforcement than having officials taking special interest in the enforcement of special laws. (Ernest Weyand, Colusa.)

POLICE RECORDS AND STATISTICS

Every department in the state, including sheriffs' offices, should be required to file with a state bureau the actual number and kind of offenses that are committed in their communities, the disposition of the cases by the police department or sheriff's office, and final disposition by the courts. (August Vollmer, Chief of Police, Berkeley.)

We have no criminal statistics worthy of the name. If we do not know—and we do not—how many crimes are committed, where, by whom, and what is done to those who commit them, we have no way of checking up and ascertaining where the trouble is. When a proper record system is advised, the answer is made that it will cost money, require additional men, a new building perhaps. Of course, it would; but what business man hesitates to incur the expense necessary to keep his records when his business runs only into a few thousand dollars? How much more necessary when, as in crime, billions are involved. (A. M. Kidd, Professor of Law, University of California.)

PREVENTION

I believe students of the subject agree that the most potent preventive of crime is the rapidity with which judgment follows the footsteps of the criminal. (Frank J. Murasky, Superior Judge, San Francisco.)

The approach, as it seems to me, should be along the practical, economic lines with which a business man solves his problems. Fortunately the enlightened public opinion is alive to the fact that this is a business problem and can not be solved by legislation any more than an insolvent business can be rehabilitated by an act of congress. (Prof. A. M. Kidd, Berkeley.)

PRISONS

I have heard it said that we did not have prison room enough to put those away who were better off in than out, and that we should build more prisons. I am of the opinion that a prison should be built in the southern part of the state, and that it should be used entirely for first timers, just the same as San Quentin has a place set aside for this class of prisoners. I believe that such a prison would prove very effective. If we had more jail room it would not be necessary to liberate so many on parole, which is sometimes done at present to so many to make room for the next bunch of "crooks" coming in. A workhouse connected with such a new insti-

tution could be made almost self-supporting by manufacturing necessary articles, such as is done in a great many other states in the Union. (T. N. Koening, Chief of Police, Sacramento.)

During the last session of the legislature I visited Folsom prison and came away firm in the conviction that our present method of treating prisoners is all wrong. Only a very small per cent of them do any actual work, so that life there is one of ease, with no worries as to where the next meal is to come from. (H. J. Evans, Assemblyman.)

The recent outbreak at Folsom called my attention to the fact that inmates of a penal institution, who have been deprived of their civil rights, are, under our system of law, entitled to trial by jury for murder, assault with intent to commit murder, or conspiracy to commit murder, in the same manner as any citizen. It appears to me that a more salutary and effective manner of handling cases of a similar nature would be to have the prison board sit as a court martial, with a right to review of their decision by the Governor, in the same manner as in cases of trials by court martial of those accused of crime while in the military or naval service of the United States. I do not believe that such a law would be unconstitutional, because the inmates of a penal institution were deprived of the rights of citizenship only after a trial by jury. Therefore, having forfeited their constitutional right, they would have no right to complain of such an arrangement. In the case of an outbreak such as the one we have in mind, the punishment of the offender would be swift and certain with a very slight possibility of a recurrence after drastic action were taken. (Edward Henderson, Superior Judge, Ventura County.)

Build a third prison in southern California where the most convicted criminals come from, and advertise to the world that California has three hard and hot prisons to receive criminals. (Fred C. Hawes, Assemblyman.)

Impress on criminals sent to state prisons that they are sent there for punishment. Remove the influence from outside sources that preach to them that they are the victims of society. (W. W. Sublett, Sheriff, Shasta County.)

The second important change that I would like to see is the segregation of convicted felons, if court laws can not be changed. I want to see in each state institution a competent physician psychologist and psychiatrist to examine and study every case that is committed; to see that treatment is given those who are possible of cure, that when their time is up that they may again become useful members of society. The old "Lex talionos" spirit is still in existence, and when education will have awakened those whose duties it is to make good out of bad, we will have progressed. (W. C. Rhodes, Sheriff, Madera County.)

It seems to me that the pampering of the criminal after conviction and sentence to the state institution is one of the serious defects of our administration of criminal justice, and in this respect I refer principally to the indeterminate sentence and early parole. (E. J. Marks, Superior Judge, Orange County.)

I also recommend that a new state prison be built in southern California and constructed in such a manner that the various types of criminals can be absolutely segregated. The road and prisons camps are ideal places for first offenders and all classes of criminals except the dangerous highway robbers and all burglars who always try to escape and go at their old professions. (C. W. Kelley, Chief of Police, Pasadena.)

The basic undertaking in dealing with the problem of criminality is to separate the sheep from the goats. The sheep can be reformed, the goats will be goats to their dying day and will beget goats after their own kind. The sheep once disinfected can be turned loose upon the hills, the goats must be herded all day and put in pens that they can not break out of when night comes, and so on until they die. The issue of a third prison has been raised. The state of New York knows about that. It has, between reformatories and prisons, "penitentiaries," places where real penitence is encouraged. It so chanced that I did not visit one of these and can not speak of their workings with knowledge, but information is available in New York. My recollection is that not all first offenders are committed to penitentiaries, but those only who, in the opinion of the committing authority, offer prospects for redemption. (A. J. Pillsbury, Berkeley.)

PRISONERS

There are two hundred World War Veterans or more in California prisons. Some of them would not be there except for the war. Many of them did their country's work well. I think some one who knows something about these men should investi-

gate their cases separately and carefully. Some of them should be in asylums. I am very much interested in these men, and, as chairman of the Disabled Veterans of the World War Community Chest Committee am also interested in some almost equally unfortunate men. We are doing a great deal for our men on the outside. I wish something could be done for the men in San Quentin and Folsom.

Recommendations.

1. Encourage the teaching of useful trades in and out of prison.

2. Secure legislation that will enable convicts to earn more money for their families while in prison.

3. Secure more careful segregation of prisoners.

4. Help men to get work and keep it after they get out of prison.

5. Work with the proper educational boards to see that the Ten Commandments and the Psalms, at least, are taught in our public schools.

6. Secure by legislation or otherwise an examination of all World War Veterans now in Folsom and San Quentin. (W. D. Potter, Berkeley.)

PRISON LABOR

The present state prisons should be provided with more facilities for the employment of prisoners. A greater expenditure of money for a better prison personnel and for shop equipment, farms, etc., would prove to be sound economy to the state. (O. H. Close, Superintendent of Preston School.)

And finally, that some provision be made for the proper training of criminals incarcerated in the penitentiaries of the state, in business and the professions, so that when they are released they may become useful citizens. That farms be provided for those who are unable to procure other honest work, so that they may be provided with employment, and that in the case of misdemeanor prisoners, such as vagrants, etc., confined in the county jails, instead of being turned out of jail at the end of ninety days or six months, penniless and worse off than when they were sentenced, that the board of supervisors be compelled to provide a fund sufficient to allow each one of these released prisoners who have no money or property at least $5 in cash and decent attire. (James C. Byers, Sheriff, San Diego County.)

I believe that our penal institutions should be self-supporting. It is astounding to me that with approximately 6000 prisoners in our prisons, practically none are engaged in profitable work. I believe that our prisons should be institutions of commerce, that factories should be established, and that every prisoner be placed at such work as he is best fitted for. And that those having no special aptitudes be trained in some particular line, so that when released each prisoner may be better fitted to rehabilitate himself. Proper wages should be credited to each of the prisoners and against this he should be charged with the full cost of his maintenance and trial. Provision should be made out of this account, during incarceration, to needy dependents. (J. J. Evans, State Senator.)

Industrial and farm activities should be vigorously pursued, state road work encouraged, and such problems as irrigation, conservation of water, reforestation, and other public betterments be considered as methods of rehabilitation of the prisoners. (August Vollmer, Berkeley.)

Extend the wage earning system more, along the present lines, both in and outside of the prison walls, teach trades, consider a toy factory in prisons. (Fred C. Hawes, Assemblyman.)

Reduction of crime: (1) That prisons, particularly Folsom, be equipped with machinery to the end that the convicts work eight hours a day making clothing, shoes, bedding, furnishings, etc., to be used only in the institutions of the state. Perhaps the cost would be greater than the present system, but the savings otherwise would be great. The argument will be made that this is an intereference with free labor, but the fact that free labor has to contribute its share of the cost of keeping felons in idleness should be something of an offset. Such labor would tend to teach the criminal class how to work and the joy of work so that when discharged they will be schooled in labor, more or less trained, instead of being schooled in idleness and trained in evasion of effort. And this should tend to reduce the number of criminals who revert to crime after their discharge. Folsom prison, particularly, in the idleness of its inmates, is a disgrace to California. (C. H. Deuel, Assemblyman.)

If it costs $217.96 per year to board a prisoner in California, and there can be 300 working days in the year, a deduction from the wages of 0.723 cents should be made to reimburse the state for that item and as much more as necessary to cover the superintending cost of the working force, and for medical care, etc. That is, each working prisoner should pay his own way, and whatever remainder there may be should go to his family if he has one or to himself when he goes out. (A. J. Pillsbury, Berkeley.)

PROBATION

It is my personal opinion that probation and the probation officers (who are no doubt conscientious and honest in their purpose, but have the angle of the criminal and his family rather than the interest of the public at heart) are responsible for a great deal of the prevalence of crime. In San Diego County the judges of our superior court, in connection with the probation department of this county, have adopted and put in effect within the last few years the policy of sentencing a prisoner convicted of a felony to the county jail for from two to three months and that probation then be granted. In my opinion this is absolutely illegal, or should be, and has the effect of generally setting aside the penal provisions of the code. I feel that such a policy generally adopted would be very detrimental to the administration of criminal justice and would tend to increase crime in California. (James C. Byers, Sheriff, San Diego County.)

If laws were enacted so as to prevent the granting of probation in cases where the jury has passed upon the facts and returned a verdict of guilty, it would prevent defendants gambling on the outcome of their trial. In other words a person who appears before a judge certainly knows whether or not he is guilty therefor, if he should expect any leniency on the part of the court he should endeavor to prevent an expense to the state and the clogging of the court calendars by going to trial and then after a verdict of guilty has been rendered, asking for probation. (D. O'Connell, Chief Special Agent, Southern Pacific.)

As to adult criminals, I am probably old fashioned in that I believe that we fail because we do not keep our promises. Many times they are warned and given probation with the understanding that if their offense is repeated they will suffer certain consequences. When that offense is again repeated instead of enforcing to the fullest extent the former promise we again temporize and again promise dire consequences for repetition, which to even an undeveloped mind carries immediately the suggestion of bluff, pure and simple. (H. A. Zink, Chief of Police, Palo Alto.)

Adopt more stringent rules regulating minors convicted of felonies for first offenses, who are given probation. And have some assistant from the probation office to be specifically detailed to see that the rules governing the probation are complied with. (W. T. Stanford, Chief of Police, Vallejo.)

In my opinion, probation, indeterminate sentences and parole are the handmaidens of crime, and have completely accomplished their purpose of creating disrespect for the law on the part of the criminal. I do not want to be understood as advocating the abolishing of probation for young offenders, who probably should be given another chance, but after a person has arrived at maturity, his criminal acts should not be excused on grounds of sentiment or sympathy. Other systems of criminal jurisprudence based upon the common law do not have the difficulties that we have, as far as the increase in the criminal class is concerned. Anyone who had had experience in dealing with criminals knows that there is an habitual type of criminal, who never wanted to be anything else and who never will be anything else but a criminal, and this class is far more numerous than the sob sisters are willing to admit, and as to this class, they should be permanently removed from society, under life sentences, and should be put to some useful, compulsory trade. (James Hollingsworth, District Attorney, Ventura.)

It is my personal opinion that if any defendant charged with a crime is entitled to consideration, that consideration should be given before judgment is pronounced. This, of course, raises the question of probation and parole. The two are sometimes confused and the one may receive the blame where the other should receive it.

I realize, however, that generally throughout the state we have a system of parole, or a law, and we have a system of probation. Neither should be made the exception, neither should be made the rule, but I do feel that if probation could be properly handled, and by this I mean sufficient probation officers, that proper investigation should be made in every case referred to them, it should be more successful.

My personal experience has been that our courts and others interested in the cases referred, seldom ever give us sufficient time to make a thorough investigation

in order that we could be certain whether the applicant had committed previous offenses or not. Add to this my statement that they tend to make a failure of many cases placed on probation. (C. W. Mathews, Chief Probation Officer, Riverside.)

Other classes of offenders should be given probation for their first offense if they are not vicious and on their second offense be sent to the state prison with the privilege of parole after serving the minimum sentence. The crime of rape by force should be punishable by death. The judge who tries the case and has all the facts before him is the best man to trust with the administration of justice and the final disposition of the prisoner. (Charles H. Kelly, Chief of Police, Pasadena.)

Limit or be more strict in the use of the power of probation. This privilege has been done to death, although I believe that conditions in this county are not as bad as they are in the extreme southern part of the state where they place criminals upon probation for everything short of murder. (David E. Martin, Superintendent of Schools, Alameda County.)

In the second place, if there is to be a continuance of the probation system, those empowered to grant probation and those entrusted with a sponsorship for the probationed persons should be put under bonds to produce at stated times the persons of those who are under probation and to furnish at any time an up-to-date, specific report based on actual and personal knowledge of the goings and comings and conduct of the probationed persons. Either the granting of probation should be abandoned, or a new significance should be given to the procedure by attaching serious and inescapable responsibility to the functions of sponsorship. In any event, there should be a rigorous curtailment of the probation privileges. (Susan M. Dorsey, Superintendent of Schools, Los Angeles.)

We are too free with probation, giving this where it ought not be given. We let the plea of insanity make "sob sisters" of us. Our imagination of sympathy is running away with ourselves. The only solution is to call a halt in these cases, and penalize to the very limit, do away with so much probation. The vigilantes in early history of California worked wonders. A consciousness of civic duty like they had is what is needed now. How to accomplish this, I do not know. (E. P. Maps, County Superintendent of Schools, Glenn County.)

PUBLIC OPINION

I am, however, of the opinion that what is most needed is an enlightened and interested public opinion and a vigorous and honest administration of the laws which we now have. I feel that so far as any new legislation is concerned that it is best to see just how the recent amendments will be of assistance before any suggestions of change be made. (Robert B. Lambert, Superior Judge, Kern County.)

The first thing necessary to improve the administration of criminal justice and reduce crime in California or anywhere else in the United States is a change of the traditional attitude on the part of the public. I believe that attitude to be better now than it was tweny or forty years ago, and that it will continue to improve. The increasing population with the enormous increase of crime in the absolute (though not, I believe, in the relative) will eventually awaken the people to the need of improvement, and the greater the need is seen to be the more rapid will be the improvement. We had the worst roads on earth twenty-five years ago, but the needs of the automobile have forced us to build probably the best. We may make as rapid improvement in the handling of crime when once the public appreciates the need. (Dr. Edward Twitchell, San Francisco.)

It is my judgment that the fundamental difficulty in the curbing of crime is the apathy of society and the lack of a genuine conviction of its steadily increasing menace to our civilization; a lack of a sense of moral responsibility for present conditions, a tendency to flame up in talk whenever a particularly atrocious criminal compels notice and then to flicker out in indifferent inaction so far as the criminal is concerned when the heinous incident is a few days old.

The most fundamental necessity in the situation is the sense of moral responsibility on the part of a sufficient number of citizens and a determination to come to grips with all weak policies and to put an end to them. (Susan M. Dorsey, Superintendent of Schools, Los Angeles.)

PUNISHMENT

I believe every sheriff and police official will agree with me that the greatest menace to life and property in California today is the highway robber and burglar. Both classes are dangerous persons and will ordinarily commit murder in order to

escape if caught in their act. In my opinion, adult burglars and highway robbers should, if convicted by a jury or if they plead guilty before the superior judge, be sentenced to a definite term in the penitentiary with a fourth of the time allowed off for good behavior while in prison. Juvenile offenders of this class should, if armed with a deadly weapon, be sent to the state reformatory and kept under discipline until twenty-one years of age. A great many of our murders in this state have been committed by boys eighteen or nineteen years old who have been released from the reformatory before learning discipline.

Kidnaping by force, either for robbery, rape, or ransom, should be made punishable by death, as there is no crime that stirs a community like the kidnaping of some person by a band of thugs and no crime causes as much agony and suffering for the parents as that of kidnaping their child, and there is not a crime more cowardly or dastardly as such an act. (Charles H. Kelly, Chief of Police, Pasadena.)

An habitual criminal ought to be incarcerated for life. By this I do not mean a person who habitually commits a misdemeanor or petty offense, but those who have entered upon a career of crime and continue to follow it as a business. That would deter the commission of crime and is justifiable for the protection of society. We have pest houses in which we incarcerate persons afflicted with contagious diseases until they are cured. That is for the protection of society, and we have leprosariums in which we incarcerate those afflicted with leprosy; that is for protection of society also and is not considered inhuman, but is considered just and right. (C. F. Curry, Congressman.)

To my mind the one big feature in the administration of criminal justice is the swiftness and certainty of the punishment rather than the severity of it. I believe that in England this has been absolutely demonstrated beyond any doubt. (P. G. West, Assemblyman.)

I feel that there are a great many petty offenses which should never have properly been made crimes, but should have possibly been made to result in a civil penalty or forfeiture to the injured party. (G. C. Darrah, District Attorney, San Joaquin County.)

It would seem that education of the criminal element is one of the important factors in reducing crime, and one of the first principles that should be taught them by example is that every crime wilfully committed and without good cause will be hastily prosecuted and punished. (Peter O'Brien, Chief of Police, San Rafael.)

It is hardly necessary to remind you that the swiftness and certainty of punishment are much more important than severity in deterring men from committing offenses against the law. If we can devise a system where arrest is prompt and sure, trial equally prompt and some punishment exacted for every proven offense, the crime problem will be reduced to a small dimension. (E. A. Walcott, Executive Secretary Commonwealth Club, San Francisco.)

I believe that while punishment is a present necessity, it would be a mistake to regard punishment, whether by imprisonment or otherwise, as a complete answer to the problem; that those states which are making the most progress are those which supplement their punishment systems with intelligent and scientific social work; that the future safety of the country will depend upon the preventive work of the present generation. Having determined what the causes of crime are we should proceed to act to prevent the continuance of conditions which we know have caused crime heretofore. (Sanford Bates, Commissioner, Department of Correction, Massachusetts.)

Society has not provided any adequate punishment for that very large group of offenders who defraud their victims by one process or another. No type of punishment for a defrauder can be considered adequate which does not compel the wrongdoer to make restitution to the person who has been robbed or defrauded. If a man or a woman who has stolen a sum of money is given a jail sentence or a penitentiary sentence with board and lodging for a period of time and then is permitted to go out into society and carry on with the funds that he or she has obtained by the commission of crime, certainly society is not dealing justly with the person defrauded or with the person who did the defrauding. The making of the proper restitution for wrong is, in most cases, a far more severe, and I believe will prove a far more deterring punishment than will a term in the jail or in the penitentiary.

There should be the same standard of punishment for offenders regardless of their station in life. The hangman's noose for the poor criminal and a short term under parole for the rich one, as punishment for the commission of similar crimes, is an outstanding menace to law and order in our country. I believe, also, that the maximum penalties which may be imposed, and which in the case of the poor and unfortunate are usually imposed, are too severe and would be too severe in the case

of the rich and the fortunate. Juries, in spite of all that the courts may tell them, have a way of determining whether in their opinion the legal penalties are too severe or not severe enough, and they have a way of attempting to settle the penalty problem by the type of verdict which they render. (Mark Keppel, Superintendent of Schools, Los Angeles County.)

RESPECT FOR LAW

No single branch of our administration attracts the personal attention that peace officers, and especially city police, do. They are usually in uniform and are performing duties which bring them into public notice. They represent to the ordinary individual the idea of law and order and constituted authority. If the public does not respect them individually it is not likely to respect the things they stand for. It is not that I think they are especially bad. The fact remains, however, that an appreciable number of the whole body disobey many of the very laws they are paid to uphold. "If gold shall rust, what shall iron do?" (Orrin J. Lowell, District Attorney, Placer County.)

I believe that there should be developed a strong public sentiment for law observance of every enactment regularly and properly passed by delegated authority; that the sentiment should be impressed to the point where the individual regards it an active duty to observe the law.

With the proper sentiment toward law observance on the part of the average citizen I am sure that your problem would not be as stupendous as it now is. There are many citizens who believe in the rule for the protection of property, who believe in the law against violence, who nevertheless deliberately and with no compunction violate numerous other laws. (Isaac Jones, Assemblyman.)

I think at the present time the principal cause of crime is the universal disrespect of all laws by the younger class of people, who have formed this habit largely through their observance of the parents and elders doing the same. (Ray Williams, Chief of Police, Porterville.)

SENTENCE

By something of a coincidence, you will note that in the column adjoining this item there is a news note from Folsom to the effect that the Prison Board has just acted upon 71 cases on the November calendar. It does not seem possible that a nonsalaried Prison Board, composed of laymen, however conscientious and well meaning they may be, can adequately classify and pass upon the myriads of cases which come to their attention, meeting as they do only once a month in each prison. (Willard W. Shea, Public Defender, Alameda.)

An extension of the indeterminate sentence to provide that offenders may be committed from zero to life in the first instance, regardless of the offense committed. It is a well-recognized fact among police officers that some individuals should be permanently detained the very first time they are apprehended, and it is just as sensible to release these individuals as it is to release persons suffering from leprosy. (August Vollmer, Berkeley.)

Another suggestion would be that the sentences or judgments pronounced in our courts should be more definite and positive. This I believe in to the elimination of the indeterminate sentence law that we now have upon our statute books. It has been my experience that many of the orders made by the courts are so complicated or so conditional that it is really impossible to enforce the order or get results from those whom the court is asking to help. (C. W. Mathews, Chief Probation Officer, Riverside.)

STATE PROSECUTIONS

I believe that a separate department of the state should be created in the nature of a state prosecutor's office, the function of which would be to safeguard the rights of the people of the State of California respecting corruption in public office. This department should have full power to proceed and prosecute any public official taking bribes or otherwise violating this state's laws. It should be fully empowered generally to institute prosecutions and should be adequately equipped with secret operatives to insure a fair measure of honesty in public offices held generally throughout the State of California. If a district attorney becomes corrupted and an honest sheriff attempts to thwart his illegal practice it is now too easy to make the honest official's efforts appear to be a political move. (Guard C. Darrah, District Attorney, San Joaquin.)

STATE POLICE

Secondly, the State of California is never going to successfully capture criminals until a police force that will coordinate is put into effect. I do not believe that we are ever going to successfully trace down the criminals who commit crimes against property until we have a state police who will work upon the theory that regardless of the size of the crime the criminal should be eventually captured. Certainty of capture, it seems to me, would be of far greater aid in the stopping of crime than length of punishment. (W. L. Bachrobt, Superintendent of Schools, San Jose.)

For more than a generation I have advocated a state constabulary for California. Crimes are committed "against the peace and dignity of the State of California," not against Alameda County, in which I now live, or against Tulare County, where I did live when train robbers came in from Oklahoma and Minnesota to rob trains while passing through Tulare County, and, by their success, to lead some of our own citizens into temptation. Tulare County went to great expense to apprehend criminals not its own. The aid of trained state constabulary was greatly needed to aid an untrained sheriff and untrained posses.

A state constabulary is needful to organize and unify the detection forces of the state and make all embracing its system of identification of suspects. Likewise to cooperate with other states in keeping tab on the comings and goings of persons with criminal records. Something is wanted somewhere betwixt the unorganized city and county police forces, as units, we now have and that liberty-destroying surveillance of Germany which will hardly permit a change of boarding places without notifying the police so that authority may know where everybody stays of nights. (A. J. Pillsbury, Berkeley.)

I believe that some effort should be put forth to properly coordinate all of the forces employed in the detection and prevention of crime, both state, county, city and the forces of the different public utilities who work daily in cooperation with the above mentioned forces. Some suitable state authority should be given to the police departments of the different public municipalities so that their power as police officers would be state wide, and it is my opinion that the state and county forces would benefit greatly if this was done. (Fred F. Phillips, Superintendent of Special Service, Santa Fe Railway.)

TWENTY-FOUR HOUR SCHOOL

As the most noteworthy progress of medicine in the last few years has been in the ascertainment of causes of disease and the application of preventive measures as opposed to the old curative processes, I feel that before we can accomplish anything really worth while in combatting or controlling crime we must know its causes and begin at the bottom. The real problem lies in just how to go about it. Probably by giving the state wide powers of custody and control of children who exhibit indications of delinquency or tendency toward crime. This will necessitate approaching the problem from an entirely different standpoint, so far as the handling of these children is concerned, my idea being that the institutions created and maintained for that purpose should be widely different from those of a penal nature now existing. The present institutions are perhaps adapted to the control of incorrigibles, but the objection lies in bringing the boy or girl with a reasonable chance for reformation into contact with those for whom there is little or no hope. The institution that I contemplate would be similar to a boarding school in that the children would be under supervision for twenty-four hours per day, subject to rules as to liberty as might properly be promulgated, and would receive instruction, both vocational and academic, in addition to moral or religious training. Get them early, create a healthy environment with proper moral guidance, and I believe that the crop of criminals can be cut in half at least. (Vernon F. Gant, Modesto.)

It is our contention that every American-born boy is entitled to: First, the right to a proper home and adequate supervision. The home is the unit of society. Second, the child has a right to an education that meets his educational need. Education is training for good citizenship.

The schools in the main are constituted to meet the need of the average boy. Very often they do not at all meet the need of the exceptional individual, often a boy brighter than his fellows, who might become an outstanding success, if his need were properly met. The twenty-four hour school would meet accepted educational standards and during an indefinite period of time would care for the needs of these exceptional boys for the entire twenty-four hours of the day, providing him with a suitable home as well as educational opportunities. There would be no commitment to such a school; a boy would be sent there as a result of the recommendation of a

committee, to consist of the school principal of the public school where the boy was in attendance, the principal of the twenty-four hour school, and a third person to be selected by these two.

Counties and combinations of counties would be enabled to establish twenty-four hour schools in connection with public school systems. While it is true that this would add somewhat to the cost of the public school system, this first cost would be exceedingly small as compared with the tremendous outlay to which the state is put in caring for the increasing number of delinquents. (K. J. Scudder, Superintendent Whittier State School.)

I have one suggestion that I would like to urge, namely: that every community should be required to provide a twenty-four hour per day school for children whose conduct in school is bad, and particularly if it is also bad out of school. There should be detention homes of some sort available to each child of the type that I have roughly described above. (H. B. Wilson, Superintendent of Schools, Berkeley.)

The 1927 statutes for the State of California have permissive legislation, providing for parental schools. These parental schools, in my opinion, should be encouraged throughout the state and should be put in the hands of people who will select highly trained professional people to conduct these schools, in order that the most benefits may be derived in training the children sent to the parental schools. The institutions in the state at the present time intended to reform misdirected youth should be in all cases under the direction of highly trained experts in this line of work and should never be filled by political appointments. (Willard E. Givens, Superintendent of Schools, San Diego.)

Encourage through state aid the establishment of parental and adjustment schools permitted under a new section of the Political Code, which provision was enacted by the last legislature. A sufficient number of these schools should be established in the future to begin this work with all children who show a criminal tendency in the early adolescent period. (Fred M. Hunter, Superintendent of Schools, Oakland.)

It seems to me that your commission could do some very valuable work by promoting discussion relative to the county adjustment schools whose establishment was authorized by the last legislature. I feel that boards of supervisors will move rather slowly in this matter, and perhaps in most cases will move only in response to pressure from the local communities. Suggestions and materials coming from your body or from some other central source from time to time would doubtless be quite helpful in bringing about the establishment of these schools. It would seem that it is necessary to exercise considerable care in connection with propaganda for the establishment of these schools. Nothing should be done to undermine the faith of the people at large in our youth. Too frequently the impression goes out that our youth are in much worse condition than actually is the case. (W. R. Hepner, Superintendent of Schools, Fresno.)

Delinquent children and defective children should not be allowed to go to school with good wholesome children. We should have separate schools for them and they should be sent there. I was very much disgusted with a boy scout executive whom I heard telling about a boy in a troop who had to be watched. He was conversing with a friend on the ferry and I couldn't help but overhear. The boy he was talking about shouldn't be in a troop or in a public classroom with decent children. (W. D. Potter, Berkeley.)

APPENDIX No. II

Suggestions and Recommendations of Judge Charles W. Fricke, Judge of the Superior Court, Los Angeles County

DEPOSITIONS

At the present time the defense is permitted to take depositions outside of the state, a right which is not accorded to the prosecution. It is suggested that the law and constitution be amended to provide that the right of the defense to take depositions outside of the state be contingent upon the same right being accorded to the prosecution, or that the people in all cases have such right.

BAIL—ARREST OUTSIDE OF COUNTY

As the law now stands, as applicable to cases of felony, if the defendant is arrested outside of the county in which a prosecution is pending, his right to admission to bail in the county in which he is arrested depends upon whether the warrant is based upon a complaint before a magistrate or upon an indictment. In the former case he may not give bail in any county other than that in which the complaint was filed (P. C. 821), but in the latter he may give bail in the county in which he was arrested (P. C. 984). Section 984 should be so amended as to permit him to give bail only before the court in which the indictment was filed.

BAIL BONDS

In view of the fact that there is nothing which will prevent sureties upon bail bonds from transferring their property after the defendant has been released, it is suggested that bail bonds should be recorded and act as liens against the realty.

PENAL CODE, SECTION 197

In subdivision three of this section, an effort was made by the legislature to declare the rule as to justifiable homicide where persons were engaged in "mutual" combat, but the statute has for a long time contained the words "mortal" combat. Our courts have held that this statute should be interpreted as though the word "mutual" was in fact used, but it would seem that the statute should be amended to correctly state the law.

INFORMATION AND COMMITMENTS

The district attorney now has the right to charge, in his information, the offense or offenses appearing from the transcript of the testimony at the preliminary examination. In this connection, the statute, section 995 of the Penal Code, should be so amended that the second subdivision one gives to the defendant the right to have an information set aside where the offense or offenses charged in the information are not sustained by the testimony at the preliminary examination. There is an additional reason for the amendment suggested to section 995. At the present time, where the transcript does not sustain the charge in the information, the man in jail has the right of release by habeas corpus, but the defendant who is out on bail has no right of a corresponding character and is compelled to go through a trial.

PRESUMPTION OF GOOD CHARACTER

At the present time the law gives to the defendant the benefit of the presumption that he has good character for the traits involved in the offense charged, and this presumption is not rebuttable, the only right given to the prosecution being that where the defendant introduces affirmative proof of such good character, such affirmative proof may be rebutted. Under our present practice where no character testimony is introduced, the court instructs the jury as to the presumption of good character in the defendant, a presumption very frequently in violent contradiction of the actual facts. The presumption of good character should either be removed from the defendant, or if it be allowed to remain, the prosecution should have the right to rebutt the same.

DISTRICT ATTORNEY SUBPOENA

At the present time the district attorney has no means whereby he can secure the attendance at his office (for examination) of witnesses, and it is suggested that an amendment to the statute be passed granting the district attorney authority to subpoena and enforce the attendance and testimony of witnesses in matters pending before him.

ATTEMPTED EXTORTIONS

Section 524 is novel in that it makes an attempt to commit a felony merely a misdemeanor. Since the viciousness of a defendant's act exists to as full an extent where an attempt to extort money is unsuccessful, this offense should be made a felony, and it is suggested that section 524 be repealed and the punishment of attempted extortion left to the provisions of section 664 of the Penal Code.

REPEATED MISDEMEANORS

There are several classes of crimes, such as issuing a series of small bad checks and larceny, embezzlement or obtaining by false pretenses of small amounts less than $200, where the aggregate amount secured by the defendant is greatly in excess of $200. In cases of this sort, it would seem that a special statute should be enacted providing in effect that wherever any person by means of the same plan, system and method secures, by means of any series of misdemeanors similarly committed, a sum of money in excess of $200, that such person be prosecuted for a felony and that the commission of such series of acts be made a felony.

WIFE AS WITNESS

Several cases have arisen recently where assault with a deadly weapon and attempt to poison has been committed upon the wife of the defendant and death has resulted, not to the wife, but to another person from the criminal act directed at the wife, and under section 1322 the testimony of the wife is not available to the prosecution. It would seem that reason and the interests of justice require the statute to be amended so as to permit testimony of the wife or, in similar cases, that of the husband, to be that of competent witnesses in cases where the offense charged also involves an offense against the spouse. As the privilege is purely statutory, this requires no constitutional amendment.

CONCEALED WEAPONS ACT—SECTION 13

As now worded, this section punishes the changing or obliterating of the name of the maker, number, or other identification mark on any pistol or revolver and the possession of such firearm is made presumptive evidence that the possessor so changed or obliterated the same. It is practically impossible to secure a conviction under this section since in all instances it would be necessary to prove, not merely that the mark had been changed, but that it had been changed since the passage of the statute. Proof is almost never available, and if this statute is to be at all effective it should punish the possessor of any firearm upon which the marks have been changed or altered and place all burden upon the defendant to show that he was not responsible in any way for such change. The Weapons Act should also be amended to punish the narcotic addict for possession of a firearm capable of being concealed upon the person by provision similar to that applicable to an unnaturalized alien.

BURDEN OF PROOF

The rule that, where a necessary fact or its absence is one more particularly within the knowledge of the accused, the burden as to the issue thereon is upon the defendant, is limited in California to cases involving the question as to whether the defendant had or did not have a license. It would seem that the rule should also include all cases in which the fact is one the proof upon which is not available and obtainable through subpoenas issued on behalf of the people, but upon which proof is obtainable by the defendant.

OBJECTIONS

The general stock, blanket and indefinite instructions should be done away with. It should be the rule by statute that no objection shall be the basis for an assignment of error upon appeal or on a motion for a new trial unless it shall have specifically pointed out the legal ground for the objection and that, if the objection

as stated is not so specific there be no error in overruling the same. A judge should never be reversed for an error until it is so clearly called to his attention that he may obviate or correct it.

JUDGMENT AND SENTENCE

There are many crimes where the penalty is such that, upon conviction, the court has but two alternatives, a sentence to state prison and probation. In this large class of offenses we find many cases where the facts and circumstances do not warrant a state prison sentence and still the accused can not or should not get probation, but should receive some punishment. The law should provide that when the minimum penalty does not exceed one year in the state prison and the maximum does not exceed fifteen years, the court may, in its discretion, impose a sentence of not exceeding five years in the county jail or a house of correction.

Since it is the defendant who occasions the expense of a prosecution, the court should have the power, in its discretion, to require the defendant to pay costs, the amount to be determined by a statutory cost bill.

Where a criminal causes a financial loss by his criminal act, he should, as a part of the penalty, be compelled to reimburse the persons suffering from his criminal act. This should be allowed as an addition to the judgment and sentence. People commit crimes because they think, sometimes correctly, that it pays; compelling the criminal to repay and reimburse makes it so unprofitable as to make it a deterrent.

PROBATION

The section (1203 P. C.) should provide that no person convicted by verdict of a jury should be eligible to probation unless the trial court shall certify that the circumstances are such as warranted the accused in defending and denying the charge. The effect would be that the guilty who hope for probation would plead guilty rather than lose the chance of probation by going to trial.

DISMISSALS

The law now gives to a defendant the right of having an action dismissed where it is not brought to trial within sixty days after the finding of the indictment or filing of the information and the trial has not been postponed upon the defendant's application. The sixty day period should date from the day of the entry of the defendant's plea of not guilty.

MOTIONS FOR NEW TRIALS

Motions for new trials are frequently based upon the matter within the knowledge of the jurors or other persons, and are presented by the defense based upon affidavit. To rebutt such affidavits, the present practice requires the filing of counter affidavits, and it is frequently very difficult, especially if the time be short, to secure the affidavits of jurors. It is suggested that the statute be amended to permit the testimony of the jurors and other witnesses to be taken before the trial court.

FORMER JEOPARDY

Penal Code section 1180 provides that "The granting of a new trial places the parties in the same position as if no trial had been had." Notwithstanding this provision, our courts have repeatedly held that, where a defendant is convicted of an offense less than that charged in the information but necessarily included therein, such conviction operates as an acquittal of the greater offense. Thus, if A were charged with murder and convicted of manslaughter, he could not, upon the granting of a new trial in the trial court or upon appeal, be tried upon his second trial for any offense greater than manslaughter. The rule is unreasonable and illogical, especially when we consider that the verdict of conviction may have been against both the law and the evidence (as in *People* vs. *Huntington*, 138 Cal. 261; *Huntington* vs. *Sup. Ct.*, 5 Cal. App. 288; *Peo.* vs. *Huntington*, 8 Cal. App. 612), and that the very error which caused the conviction for the lesser offense is the basis for the granting of a new trial. The law should be amended to expressly provide that, upon a conviction of a lesser offense and the granting of a new trial, such conviction shall not operate as an acquittal of any offense included within the indictment or information. The effect of such amendment would place the accused upon the second trial under the charge originally filed, which is as it should be.

Furthermore, a defendant in such a case would be less likely to appeal if he knew that a reversal might result in his ultimate conviction of the major crime.

INSANITY

This state now follows the rule in *McNaughton's* case, commonly known as "the right and wrong" test, but the rule has never been put in statute form, our only provision being section 26 of the Penal Code, which declares that "lunatics and insane persons" are incapable of committing crime. Our courts, however, have occasionally loosely injected a foreign element into the rule by their statement that "If appellant * * * had sufficient mental capacity to appreciate the character and quality of his act, knew and understood that it was a violation of the rights of another and in itself wrong, knew that it was prohibited by the laws of the land and that its commission would entail punishment and penalties upon himself, if he had the capacity thus to appreciate the character and comprehend the possible or probable consequence of his act, he is responsible to the law for his act." (*Peo. vs. Oxnam*, 170 Cal. 213.) The underlined portions of this statement of the rule, frequently included in instructions to the jury, are not the law. Knowledge that an act is prohibited by the law of the state and its commission will entail punishment is in no sense a requirement to criminal responsibility; it is well settled that ignorance of the law under which the accused is prosecuted is no defense. The term "idiots" as used in section 26 should also be defined.

CRIMINAL COURT OF APPEALS

There are so many criminal cases on appeal and the criminal law involves so many rules of its own that it is not surprising that rehearings in criminal appeals so frequently result in a reversal of the first opinion on appeal. Also we find one district court of appeal holding one way on a proposition of law while a similar court for another district holds otherwise. In the criminal law, particularly, a close familiarity with the precedents and the code provisions is essential. Numerous instances could be decided where an appellate court in rendering its decision wholly overlooked a former decision of authority or a statutory provision directly in point. A court specializing on criminal appeals could so familiarize itself with the body of the criminal law that its decision on appeal would, in most cases, be final, or at least be affirmed on rehearing before the Supreme Court. We can not close our eyes to the fact that, of recent years, rehearings in the Supreme Court and even in the same District Court of Appeal have resulted in a flat reversal of the former opinion on appeal. This is no reflection upon our appellate court judges, but is a result of their multifarious duties precluding a thorough familiarity with the criminal law which is still looked upon as a stepchild of jurisprudence and treated accordingly.

IMPEACHMENT OF WITNESS

Under the present rule, the party producing a witness can not impeach such witness by showing that he has at other times made statements in variance with his present testimony, unless the witness testifies adversely to the party producing him. This rule should be modified so as to permit the impeachment of such a witness, where the party calling him is compelled to call such witness by reason of the fact that he is the only person having knowledge of the matter in question, so far as is known. This could be brought about by an amendment to section 2049, Code of Civil Procedure.

REFRESHING THE MEMORY

Section 47, Code of Civil Procedure, permits a witness to refresh his memory to a writing made by himself or under his direction, and some of our courts have construed this statute as excluding all other means of refreshing the memory. The section should be amended to permit a witness to refresh his memory by examination or reference to any object or thing which would, according to the foundation laid by his statements, bring back to mind facts which have slipped his memory.

IMPRISONMENT FOR NONPAYMENT OF FINE

Our Penal Code contains two provisions authorizing courts to provide that, in the default of the payment of a fine, the defendant may be imprisoned for a specified length of time until the fine is satisfied. Section 1205 refers exclusively to superior courts and section 1446 refers exclusively to justices' courts. The

code should be so amended as to give the superior court the same power which is now possessed by the justice court, or one section should be enacted to cover all courts. As the law now stands, the justice court has greater powers in this connection than is possessed by the superior court.

BURGLARY WITH EXPLOSIVES

Although all other burglaries do not require the element of "breaking," the crime of burglary with explosives, section 464, Penal Code, the most aggravating form of burglary, requires in addition to the entering with criminal intent that there be also a breaking, and the addition of this element of breaking places an unnecessary burden upon the prosecution and opens the door to technical defenses.

MEANS USED TO COMMIT CRIME

There is now no adequate provision for the disposition of articles used as the means of committing crime, and it seems that the law which provides that exhibits in a criminal case be returned to the owner or person entitled to the possession thereof would permit the return of the means used to commit a crime to the defendant or his transferee. A definite statute should be enacted providing that all articles used to commit a crime be deemed nuisances and contraband, and that, upon conviction, they be confiscated and sold or destroyed, except that where such objects are not of themselves of unlawful character, that the court may direct other disposition of the same.

CONCURRENT AND CONSECUTIVE SENTENCES

Section 669 regulates by statute when sentences shall run consecutively and when concurrently, and takes from the court all power to control the running of sentences. For example, if a person on each of three consecutive days were convicted and immediately sentenced for three separate grand larcenies, such sentences must run concurrently, but if all three offenses were tried jointly and the defendant convicted upon each, such sentences must run consecutively. Under our present law, if a man be charged jointly with three grand larcenies, if he plead guilty to all three before being sentenced on either, his three sentences must run consecutively unless the court orders otherwise, but if he plead to the first count and received a sentence thereon, then plead to the second count and received a sentence thereon, and then plead to the third count and received a sentence thereon, such sentences must run concurrently. It would seem advisable, also, that where a person has been convicted on one offense and sentenced thereon, the court should have power, upon a subsequent conviction of another offense, to order that the sentence upon the second or last trial follow the expiration of the sentence for the offense first tried, or run concurrently.

STATUTE OF LIMITATIONS

It seems to be the law that, when a person is convicted of an offense less than that charged in the indictment or information, but necessarily included therein, that the statute of limitations which applies to the cause is the statute which would apply had the indictment or information charged the offense on which the defendant was convicted. Thus, if a person were prosecuted for an assault with a deadly weapon two years after such assault was committed and the jury convicted only of simple assault, the accused would escape punishment because a misdemeanor is barred by the statute; similarly, if a man were prosecuted for murder and the indictment or information were filed more than three years after the commission of the crime, a conviction of manslaughter would be barred by the statute. This situation should be changed.

ATTEMPTS

Section 664 of the Penal Code, enumerating certain attempts to commit felonies and prescribing the penalties therefor, does not include attempts to commit burglary of the first degree and, consequently, in cases of conviction of such crime the court can not sentence under the indeterminate sentence law, but must sentence defendant for a definite term of years. The section should be amended so as to bring all attempts to commit crime under the indeterminate sentence law.

THE INSANITY DEFENSE

While the 1927 amendments separated this defense (that defendant was insane at the time of the act charged) from the principal question as to whether the accused committed the act charged, it will be noted from an examination of section 1026 that no procedure is laid down for the trial of the issue raised by the plea of "not guilty by reason of insanity." For example: Nothing is said as to whether the defense or the prosecution has the right or duty to open and close the proof and argument, how many challenges are to be allowed to each of the parties or whether the number of such challenges be the same as would have been allowed under a plea of not guilty under the same charge. It would seem that section 1026 should have provided in effect that the procedure in the trial of the insanity issue be, except as expressly modified, the same as though it were, as heretofore, tried along with the issues raised by a plea of "not guilty."

A more serious question arises under the provision of section 1026 that, in separate trial under a plea of "not guilty," the defendant "shall be conclusively presumed to have been sane at the time it is alleged to have been committed." The word "sane" is not defined by the section. If it be considered as the opposite of "insane" (and since, in medicine, insanity is a disease of the brain causing a departure of the individual, in his thoughts, acts, mental or physical functioning, from his normal) the presumption of the statute excludes all forms of insanity. If this be so, what then will occur if the accused, though not legally insane under the "right and wrong" test, was suffering from a mental disease which either prevented him from forming the specific intent constituting an element of the *corpus delicti* or was relevant to the question of intent, degree of the offense or mitigation of the offense, especially where the crime is one in which the jury recommends the penalty by their verdict as in murder, statutory rape or driving a vehicle under the influence of intoxicating liquor (Sec. 112 Cal. Vehicle Act)? Can the legislature conclusively presume a defendant free from mental disease where such disease falls short of that insanity which is a defense to a criminal charge but still so affects the mental operations of the accused as to throw light upon the criminal intent, the presence of all the elements of the *corpus delicti* or the questions of penalty or identity to be passed on by the jury? These problems are worthy of serious consideration.

If the word "sane" in the statement of the presumption merely means "not legally insane to a degree which would constitute a complete defense," then evidence is still admissible to show mental disease of a different or lesser degree or character.

INSTRUCTIONS

One of the prolific sources of appeals and reversals is the question of instructions. It is suggested that the respective parties be required to serve upon one another their proposed instructions. That the same be submitted to the court and an opportunity afforded each party to object to the instructions thus offered and that no error may be predicated upon the giving of an instruction given unless objected to prior to its being given and that no error may be predicated upon the failure of the court to instruct the jury unless the court was requested to so instruct the jury.

As it frequently happens that the court should or could well amplify or modify the requested instructions it is suggested that the present law be changed so that the court may instruct the jury orally and without the necessity for written instructions provided that such instructions be taken down in shorthand by the court reporter. This authority would permit the court to greatly simplify the instructions and render them more valuable to the jury.

The law should also provide that the jury be instructed before the argument of counsel. This would simplify matters for counsel, eliminate arguments based on speculation as to what instructions the court might give and limit the argument by the law contained in the instructions. It is suggested that all general instructions—those as to duties of jurors, reasonable doubt, credibility of witnesses, etc., be given before any evidence is taken. It would seem more logical to inform the jury as to these matters at the beginning of the trial, to instruct them as to their duties and functions before they render the service, to furnish them with working tools at the beginning of the work.

CHAS. W. FRICKE,
Superior Judge, Los Angeles County.

APPENDIX No. III

Proposed Reforms in California Criminal Law and Procedure Submitted by Prof. C. G. Vernier, Stanford University

To the California Crime Commission:

The following changes in the criminal law and procedure of California are suggested because they are believed to be desirable and without regard to present constitutionality or political expediency.

1. ASSAULT.

Amend Penal Code section 240 to omit from definition of assault "coupled with a present ability."

Actual present ability not needed at common law, nor by statute in most states. Should be omitted because it has nothing to do with the intent of defendant or harm to the victim or the state.

See 2 Bish. New Crim. Law (9th ed.), Sec. 32.

2. Even if Penal Code section 240 is not changed, Penal Code section 417 should be amended to punish threatening use of an unloaded gun. At present punishment is provided only for threatening use of "deadly weapon * * * in the presence of two or more persons."

3. BIGAMY.

Amend Penal Code section 282 to make bona fide and reasonable mistake of fact or law a defense.

This is the English rule and should be the rule in all cases of felony.

References:

1 Bish. New Crim. Law (9th ed.), Sec. 291b.
13 Harv. L. Rev. 50.
3 Harv. L. Rev. 180.
3 Calif. L. Rev. at 452.
27 L. R. A. N. S. 1097.
7 Calif. L. Rev. 1.

4. JEOPARDY.

Jeopardy should not apply until final verdict on the merits.

Present rule too favorable to the accused and favors the release of guilty parties on technicalities. Properly construed, jeopardy rule forbids being tried twice for the same offense. There has been no trial until verdict rendered. Suggested rule is already followed in some states and adopted by the Mississippi constitution of 1890.

References:

11 Jour. Crim. Law 344 at 360 (Millar on Modernization of Criminal Procedure).
9 J. Am. Jud. Soc. 136 (same article).

Contra argument:

1 Bish. New Crim Law (8th ed.), Sec. 1019.

5. JEOPARDY—Effect of grant of new trial.

Where verdict is set aside on motion for new trial or appeal by defendant entire case should be reopened; e.g., on trial for murder and conviction of manslaughter, entire question of guilt should be open on new trial.

Reference:

Calif. B. A. Proc. 1926, p. 248 and p. 192. Approved by Calif. Bar Assn.

6. MURDER.

Amend Penal Code section 187 to eliminate malice aforethought in murder.

This has been done in Dakota, Florida and New York and in New Indiana Penal Code. See excellent argument in 167 Kentucky, 365. Term is misleading, technical and confusing. Murder is in reality the killing of a human being

without legal justification or excuse, and under circumstances insufficient to reduce the crime to manslaughter. See 2 Stephens History of Crim. Law of Eng. 119.

7. MURDER.

Penal Code section 188 should be amended to eliminate the suggestion of implied malice "when the circumstances attending the killing show an abandoned and malignant heart."

See No. 6.
S. V. McGuire, 38 L. R. A. N. S. 1045 and note.
Turner vs. Comw., 167 Ky. 365.
10 U. of Illinois Bul. 34 (Prof. Green).
(Professor Greene: "It has been said that legislatures and trial judges may no longer torture prisoners, but they keep on torturing the English language").

8. SOLICITATION.

A section should be added to Penal Code making solicitation to commit crime (at least in case of felonies) criminal. At present solicitation seems to be criminal only in certain specific cases, leaving uncovered certain more important ones. California seems to be unique in this regard.

9. SELF-DEFENSE.

Amend Penal Code section 197 cl. 3 by substitution of "mutual" for "mortal." See commissioner's note. Term "mortal combat" as there used is a misprint and makes a rule unknown to common law or law of any other state.

10. LARCENY—Of goods rescued.

Penal Code, section 500, amend to eliminate "in the city and county of San Francisco." If conversion of goods rescued is to be criminal it should apply to state generally.

11. PROCEDURE—Stay of execution.

There should be no stay of execution on appeal except in capital cases or unless ordered by court to which appeal is taken.
Calif. B. A. Proc. 1926, pp. 248 and 192. Approved by Bar Assn.

12. VERDICT.

Allow three-fourths (or five-sixths or eleven-twelfths) verdict except in case of death penalty or life imprisonment. Arguments on this are too well known to need repetition.

See
Calif. B. A. Proc. 1910, pp. 16–18.
Calif. B. A. Proc. 1911, pp. 14–28.
Calif. B. A. Proc. 1912, pp. 27–38.
Calif. B. A. Proc. 1913, pp. 141–2.
Calif. B. A. Proc. 1921, pp. 133–5.
Approved by Calif. Bar Assn.
2 Journ. Am. Jud. Soc. 177 (favored).
1 J. C. L. 465–6 (note).
13 J. C. L. 298–300 (note).
13 Univ. of Ill. Bull. 34 (Judge Harker).
11 J. C. L. 355 (Prof. Millar).

13. PROCEDURE–Rules of Court.

Authorize Judicial Council to make rules of procedure in criminal cases, even to extent of changing present statute rules.
See:
55 S. N. Rec. 10, Jan. 23, 1928 (editorial and references).

14. PROCEDURE–Comment on defendant's failure to testify.

Both court and counsel should be permitted to do this.
Allowed Ohio Const. 1914.
Jury is bound to consider this and properly restrained argument should be permitted.

See:

11 Journ. Crim. Law 351 (Millar).
5 Journ. Crim. Law 923-5 (note).
Calif. B. A. Proc. 1910, pp. 17-21.
Calif. B. A. Proc. 1911, pp. 162–6.
Calif. B. A. Proc. 1916, pp. 297-8.
Calif. B. A. Proc. 1919, pp. 92–3, 194.
Calif. B. A. Proc. 1921, p. 210.
Calif. B. A. Proc. 1926, pp. 247 and 185.
Approved by Bar Assn.

15. VENUE.

People should have right to change of venue.
Calif. B. A. Proc. 1919, pp. 195 and 93.
Approved by Bar Assn.

16. PROCEDURE—Comment by trial judge on evidence.

This should be permitted as at common law.
Permitted in Mich. in 1927. (See S. F. Recorder, Oct. 13, 1927.)

See also:

2 Marquette Law Rev. 67-72 (Hoyt, 1927).
Calif. B. A. Proc. 1910, pp. 22, 3.
Calif. B. A. Proc. 1911, pp. 38–51.
Calif. B. A. Proc. 1913, pp. 26–7 (contra).
Calif. B. A. Proc. 1917, pp. 231–43.
Calif. B. A. Proc. 1919, pp. 85–103.
Calif. B. A. Proc. 1924, pp. 224–40 (Bledsoe).
Calif. B. A. Proc. 1926, pp. 185, 162-185, 247.
13 Journ. Crim. Law 507-13 (Meyers).
Calif. Bar Assn. has both approved and disapproved. Latest action favors this change in law.

17. PROCEDURE—Alibi.

Require defendant to give reasonable notice of alibi to be relied on.
Such is practice in Scotland.
This much abused defense needs to be checked in interest of truth and justice.
See:

Calif. B. A. Proc. 1926, pp. 190 and 248.
Approved by Bar Assn.

And see:

9. Journ. Am. Jud. Soc. 139.

18. POLICE.

Provide for state police or constabulary.
The arguments for this are generally known.
Those opposed are mostly political and based on fear.

See:

14 Journ. Crim. Law 544-55 (Bibliography of articles on State Police).
15 Am. Pol. Sci. Rev. 82-93 (Conover).
Fosdick—American Police Systems (1920).
Bruce Smith—The State Police (1926).
Calif. B. A. Proc. 1919, pp. 86-95.
Calif. B. A. Proc. 1920, pp. 118, 315–18.

19. STATISTICS.

Provision should be made for a central state bureau for collection of statistics—with power to suggest forms of report and with penalties for failure to make required reports.

The need of more adequate statistics has long been felt. More statistics of a reliable sort are a fundamental requirement for a further study of causes and repression of crime. References are legion. Here are a few:

Koren—"Things we don't know about crime.." 13 Jour. Crim. Law, 446-52.
Robinson—History and organization of criminal statistics in U. S.

Gault—First Steps in Developing a System of Criminal Statistics. 10 Jour. Crim. Law, 485–9.
The Proposed Illinois Bureau of Criminal Records and Statistics. 12 Jour. Crim. Law, 518–28.
1927—U. S. Census Bureau Pamphlet—"Instructions for compiling criminal statistics."
Calif. B. A. Proc. 1923, pp. 68 and 225. (Approved by Bar Assn.)

20. PSYCHOPATHIC LABORATORIES.

Provision should be made in increasing measure for expert study of crime and criminals. There should be a state bureau with assignment of services to places where most needed, especially larger cities and penal institutions. There should be no probation or parole without expert examination and report. If criminology is a science provision must be made for expert study. Recent developments point to an increasing use of this proposal.

See:

O'Neill—"A plea for the complete medical, psychological and psychiatric examination of all persons accused of crime."
1927 Proc. Int. Assn. Chiefs of Police, pp. 156–61.
36 Yale Law Jour. 632–48 (Glueck).
47 Am. B. A. Rep. 629–33 (Adler).
13 Journ. Crim. Law 74–81 (Healy).
16 Journ. Crim. Law 602–6—Bibliography Calif. Bar A. Proc., p. 224.
10 Journ. Crim. Law 143–4 (San Quentin).
8 Journ. Crim. Law 113–5.
8 Journ. Crim. Law. 362–4 (Adler).
2 Journ. Am. Jud. Soc. 67 (Editorial).
5 Journ. Crim. Law. 840–50 (Anderson).
7 Journ. Crim. Law 21–5 (Jacoby).
4 Journ. Am. Jud. Soc. 24–31 (Olson).
9 Journ. Crim. Law 279–82 (Report of San Francisco Com. for the advancement of medico-psychological examinations of adult and juvenile delinquents.
13 Journ. Crim. Law 485–93 (Shepherd).
36 Har. L. Rev. 333–7 (note).

21. JAILS—Penal Farms.

Provide that all persons now sentenced to jails for more than 30, 60, or 90 days shall be sent to central penal farms. It is hard to find any one who will say a good word for jails today. Their use should be confined to temporary detention.

See:

17 Journ. Crim. Law 626–39. Selected.
Bibliography on Farm Colonies for Misdemeanants.
Queen—The Passing of the County Jail (1920).
1916 Report of State Board of Charities and Corrections on Calif. Jails.
The County Jail Must Go. 14 Jour. Crim. Law 151–4.
7 Journ. Crim. Law 379–92 (Cross).
3 Journ. Crim. Law 299 (Movement for Industrial Farm in Calif.).

22. INSANITY.

Provide for routine examination of certain arrested persons prior to trial with Massachusetts law of 1921 as model. For comment and suggested improvements see:

16 Ill. Instn. Quarterly, p. 10 (June, 1924).
14 Journ. Crim. Law 573.
7 Journ. Crim. Law 573–88 (Glueck).
7 Journ. Crim. Law 614–6.
1 Journ. Crim. Law 858–67 (Kinberg on Swedish practice).

23. INDEMNIFICATION.

Provide indemnification under proper safeguards for persons erroneously convicted. Justice requires that some effort be made to compensate the innocent victims of our defective system of justice. The need for this becomes greater

as the enforcement of the criminal law is strengthened and rights of the accused diminished.

See:

Borchard—European Systems of Indemnification.
3 Jour. Crim. Law 648–718.
3 Jour. Crim. Law 665–7 (Editorial—Wigmore).
4 Jour. Crim. Law 589–90 (note).
2 Jour. Crim. Law 767–8 (note).
3 Jour. Crim. Law 108 (note).
2 Jour. Crim. Law 912 (note).
39 Am. Bar Assn. Rep. 1121–2.

24. COURTS—Municipal vs. Police

Provide for mandatory abolition of police courts and substitution of municipal courts in larger cities. Have worked well in Chicago, Cleveland and New York. Advantage of better qualified judges, more dignity, higher jurisdiction and better salaries. Also chance for central organization and specialization.

See:

Calif. B. A. Proc. 1924. 157–64.
Calif. B. A. Proc 1924. 251–6.
Approved by Bar Assn.

25. DIVORCE PROCTOR.

Should not some provision be made to put an end to the orgy of collusion and perjury in divorce cases?

26. WITNESSES—Nonesident.

Suggest a study of the law to secure compulsory attendance of nonresident witnesses—drafted by the Commissioners on Uniform State Laws.

See:

1927 Handbook, pp. 913–18 (copy of final draft).
Calif. B. A. Proc. 105–18, 311, 241–44.

27. COMPROMISE OF CRIME.

Should be regulated.

See:

Miller, 1 So. Calif. L. Rev. 1–31.

28. PUBLIC TORTS–Reclassification of Crimes.

With the immense growth of minor statutory regulations, the number of criminal misdemeanants has become so large as to include most of the population. The proper administration of the law is impeded thereby. It seems hopeless to advocate repeal of these laws. In my opinion they will increase in number rather than diminish.

In order to divide the population more clearly into a criminal and non-criminal class, would it not be advisable to drop from the criminal classification many of these minor statutory regulations, not involving moral turpitude, and classify them as public torts and provide for a separate system of enforcement? To do this would be a big undertaking, but it seems to me one that might be worth while.

29. RECOVERY OF CIVIL DAMAGES IN CRIMINAL PROSECUTION.

Suggest a study be made of the system by which this is done in France, the Philippines, and various foreign countries.

See:

Millar—The Modernization of Criminal Procedure, 11 Jour. of Crim. Law 347–50.
79 Cen. Law J. 68, note.
25 Yale Law Jour. 282.

30. EMBEZZLEMENT.

Amend Penal Code section 514 to provide it shall be a felony to embezzle a series of sums in one employment less than $200 each but amounting to that in total.

Calif. B. A. Proc. 1915. pp. 154–7.

31. REASONABLE DOUBT.

Penal Code 1096–7. Should not this section be reworded to make it clearer to a jury?

Calif. B. A. Proc. 1912. pp. 255–6.
Calif. B. A. Proc. 1912. pp. 265–7.

32. JUVENILE COURT—Jurisdiction.

Amend Juvenile Court Law (Gen. Laws 1925. Act 3966) to make it conform on the question of jurisdiction to the recommendation of the National Probation Association and the Children's Bureau, viz. to make the jurisdiction of the juvenile court exclusive, without power of the juvenile court to waive jurisdiction.

See:

Children's Bur. Pub. 121.
Detailed argument attached for a compromise view.

On Juvenile Court Act; General Laws 1925; Act 3966—The Committee of the National Probation Association and the Children's Bureau of the Department of Labor who reported on juvenile court standards would attack our California juvenile court law on several grounds. They maintain that the "juvenile court should be vested with exclusive jurisdiction in certain specified cases" (the type of case where California gives the juvenile court jurisdiction) and that "the juvenile court should not have the power to waive jurisdiction and certify the cases for trial in another court."

U. S. Dept. of Labor Children's Bureau Pub. 121. I The Court C (1) (a).

The California law is in direct conflict with this idea inasmuch as section 4c of the General Laws 3966 provides that any person shall be prosecuted under the general laws of the state if the juvenile court shall deem that person unfit for consideration under the juvenile court act. This provision to a great extent overcomes the very purpose of the juvenile court law—to have the child treated not as a criminal but as a ward of the state in need of care, protection and guidance which the court will exercise in lieu of the parents' inability to do so.

The effect of this section is modified by 4d of the act, which says that no person under 18 shall be prosecuted for crime until the matter has first been submitted to the juvenile court. Section 6 of the same act goes into great detail as to the mode of procedure to be used in referring juvenile cases by the magistrate's court to the juvenile court. Yet cases are coming up constantly where it is being decided that these sections do not deprive the magistrates and superior courts of jurisdiction where the infant defendant does not assert his age to the court. (*People* vs. *Oxnam*, 170 Cal. 211; *In re Northon*, 35 Cal. Ap. 369; *In re Bartiani*, 253 Pac. 951; *In re Tom*, 121 Pac. 294. The decisions can only be reconciled with the statute by construing section 4d as not affecting the jurisdiction of the magistrates and superior courts over juvenile cases. Such a construction permits any tribunal to hear the case of a juvenile delinquent unless said person asserts his age before this tribunal. Section 6, however, states that if the age "of defendant is suggested or appears" to the magistrate to be under 18 that he shall certify the case to the juvenile court. Reading section 6 in the light of section 4d would let us believe that the legislature intended to take a middle position between the Juvenile Court Standards Committee idea and the construction given by the cases.

To make the law clearer and to avoid the technical pitfalls now possible by the long and involved phrases of section 6 the legislature would be wise to amend this section to read practically the same as does the Illinois section on this subject. (Cahill, Ill. Revised Laws 1927. Chap 23, Sec. 333.)

> "When a person under 18 is brought before the magistrate's court it shall be the duty of the magistrate to certify to the juvenile court of his county that (a) said person (name) is charged with a crime (state nature of alleged crime), and (b) that person is believed to be under 18."

Then to change 4*d* to read:

> "No court shall have jurisdiction to hear the case of a person under 18 at the time of commission of alleged offense until the matter has first been submitted to the juvenile court."

The provision of the statute of limitations of section 6 could remain, the other sections devoted and distinguishing the cases of juveniles between 18 to 21 are covered under sections 14, 4*c* and 7.

Such a change would materially aid in carrying out the purpose of the juvenile court law. It would be the next best solution to the adoption of the Juvenile Court Standards Committee suggestions in full which would necessitate destroying section 4*c* entirely and amending 4*d* and 6 to read as suggested above.

APPENDIX IV

Communication from General Tirey L. Ford

Thursday, March 1, 1928.

Mr. Chris B. Fox,
Secretary, Crime Commission,
Tribune Tower,
Oakland, California.

Dear Sir:

This is in reply to your previously acknowledged letter of January 14, 1928.

The statute creating your commission (Stats. 1927, p. 668) directs that a study be made of "the entire subject of crime" and "the entire subject of penology," with particular reference to conditions in California, including:

(1) Causes of crime.
(2) Possible methods of preventing crime.
(3) Methods of detecting crime and the apprehension of criminals.
(4) Methods of prosecution of persons accused of crime.

The views I shall here express will, in the main, be confined to "Possible methods of preventing crime" and to "Methods of prosecution of persons accused of crime," with only incidental reference to "Causes of crime" and to "Methods of detecting crime and the apprehension of criminals."

Permit me to say, preliminarily, that the problem presented to your commission is the one great vital and fundamental problem confronting organized society. Commercial and industrial problems will eventually solve themselves. Government may temporarily influence commerce and industry, but, in the long run, immutable laws of trade will control the industrial world. The one field in which government is faced with a never-ending duty and a grave and mighty responsibility, shared though it be with the home, the school, and the church, is that of the prevention and suppression of crime. The importance of this governmental function can not be overemphasized, and yet, strangely enough, save when aroused by some brutal or otherwise sensational crime, it is the one governmental function in which the average citizen ordinarily takes the least interest.

If your commission can map out effective governmental methods for the solution of the problems here suggested and can cause public attention to be focused upon them, your commission will have performed a service of the highest possible value to California.

POSSIBLE METHODS OF PREVENTING CRIME

Crime, as defined by statute in California (Penal Code, Sec. 15), is "an act committed or omitted in violation of a law forbidding or commanding it, and to which is annexed, upon conviction, either of the following punishments" (enumerating them). Stated more simply, crime is the disobedience of some rule adopted by the state for the conduct of its citizens, and for which disobedience certain punishment is prescribed. The essence of crime is disobedience. If there were no disobedience there would be no crime.

Experience and observation have shown, and investigation has demonstrated, that disobedience in childhood is likely to result in lack of respect for constituted authority in manhood. When childhood is uncontrolled manhood is, to say the least, uncertain. Experience and observation have equally shown, and investigation has likewise demonstrated, that the obedient child, the child that has been taught habits of order and neatness; that, through parental love, training, influence, and example, has come to respect parental authority; that has learned to respect and obey the rules laid down for his guidance, whether at home, at school, or on the playground; that such a child, with habits thus fixed, will seldom disobey the rules prescribed by proper authority for the guidance of his maturer years.

In the main, then, and leaving heredity out of consideration (a factor not yet demonstrated to be conducive to criminal tendencies), and omitting psychological, mental, and other special, peculiar, and limited, causes, the genesis of crime is neglected youth. By "neglected youth" is not meant the neglect of poverty. The child of the humblest home may be taught obedience, respect, and orderly habits, while the child of wealth may grow to manhood unrestrained. By "neglected youth"

is meant the absence of those guiding influences of the home, the school, and the church, that make for love, obedience, and a decent respect for constituted authority.

The Problems Presented.

Crime prevention involves three main problems:

(1) Prevent as many children as possible from becoming criminals.
(2) Prevent as many criminals as possible from remaining criminals.
(3) Prevent those remaining criminals from committing crime.

The first of these problems (preventing children from becoming criminals) must, in its very nature, depend for its solution upon the home, the school, and the church. It is overwhelmingly the most important of the three main problems suggested, and yet it is the one concerning which the state, in its governmental capacity, can do the least.

The burdens of the second problem (preventing criminals from remaining criminals) must fall in large measure upon the state, to be met by such governmental agencies as juvenile courts, juvenile reform schools, reformatories for adult first offenders, and state prisons.

The third problem (preventing those remaining criminals from committing crime) is one wholly for the state, acting through its state prison authorities under appropriate legislation.

The principal agencies, then, for the prevention of crime, aside from the all-pervading influence of religion, are:

(1) The home.
(2) The school.
(3) The juvenile court.
(4) The juvenile reform school.
(5) The reformatory for adult first offenders.
(6) The state prison.

To these I would add, in aid of the state's activities, the helpful influence of probation and parole and, as a final and indispensable element, I would add the indeterminate sentence.

I assume the commission will not attempt to deal with the home and the school, further than to point out their tremendous importance as agencies in the prevention of crime.

I do not feel that my knowledge of the juvenile court and the juvenile reform school is sufficient to warrant my attempting to express any helpful views thereon.

I have, however, given some thought and study to the reformatory for adult first offenders and to the state prison, and concerning these I shall express the views that have resulted from such thought and study.

Generally speaking, the same problems enter into the conduct and management of both reformatories and state prisons, the reformatory being really a junior state prison. To both are committed those only who have been convicted of felonies. Those within a prescribed age limit, upon their first conviction of a felony, are sent to the reformatory for adult first offenders. All others are sent to the state prison. To both prison and reformatory certain fundamentals apply. These fundamentals are clearly set forth in a special report on reformatories made to the Governor by the State Board of Prison Directors in 1910, and they are substantially as follows:

The first attention is given to the physical defects of the prisoner, if any exist. A sound body is much better than a weak one upon which to build sound moral and mental structures. Next, any mental deficiencies of the prisoner must receive attention. A trained and intelligent mind more quickly responds to moral teaching and training than does the less efficient mind. With the care of the body and the training of the mind there must go forward the moral reformation of the prisoner, which is the ultimate object sought. To this end the prisoner must be trained to cleanly personal habits; to regularity of hours; to industry and thrift; to clean habits of thought and conversation; to a correct understanding of his relations toward society; and he must leave the prison equipped to earn an honest living and to take his place among the respectable citizenship of the state.

These are the fundamentals. The details must conform to the problems daily presented—problems as varied as the prisoners are numerous. Suitable trades and occupations should furnish wholesome employment for the prisoners. Productive labor has a real therapeutic value in criminal reformation, the importance of which can not be overestimated. By "productive labor" is meant labor that produces

something useful, something of value. Mere routine monotonous labor, like building a brick wall and then tearing it down, may teach the prisoner how to lay brick, but it lacks the vitalizing influence of the worthwhile labor that produces in the worker a feeling of genuine accomplishment.

California has no reformatory for adult first offenders. It is the one missing link in her governmental chain of penological agencies. A bit of history at this point may not be without interest.

In its biennial report of 1908, the State Board of Prison Directors recommended the establishment of a reformatory for adult first offenders. At its session of 1909 (Stats. 1909, p. 876) our state legislature passed an act which was approved by Governor Gillett, directing the State Board of Prison Directors to gather all data necessary to enable it to make a full and comprehensive report to the Governor concerning a reformatory institution, including estimates of the cost of suitable grounds and buildings, and the best methods of management as developed by a research, study, and investigation, of other penal and reformatory institutions.

In 1910, pursuant to this statutory mandate, and as President of the State Board of Prison Directors, I visited, in behalf of the board the reformatories at Pontiac, Illinois; Mansfield, Ohio; Huntington, Pennsylvania; Rahway, New Jersey, and Elmira, New York. These were the leading and typical reformatories in the United States. In November, 1910, I made an elaborate report to the board which was embodied in their official report made to the Governor in the following month of December.

At the ensuing session of 1911 (Stats. 1911, pp. 1088-1092) the legislature passed an act (introduced by Governor Young, then a member of the assembly) establishing a reformatory to be known as the "California State Reformatory." Provision was made in the act for the purchase of land and the construction of buildings thereon, also for the conduct and management of the reformatory by the State Board of Prison Directors. An appropriation was made to carry the act into effect and a tract of land was purchased in Napa County. But nothing further was ever done and ten years later, in 1921 (Stats. 1921 pp. 1051-1052) the act was repealed and the control of the land that had been purchased was vested in the State Department of Finance.

Thus California is still without a reformatory, with the result that youthful first offenders who are convicted of a felony must be committed to an overcrowded state prison along with seasoned veterans in crime.

Parole and the Indeterminate Sentence.

I deem the parole law of this state the greatest step forward yet taken by California in her penological progress. And her crowning achievement will be appropriate legislation providing for the indeterminate sentence. Perhaps my own views can the better be presented by relating how I came by them.

In April, 1905, I became a member of the State Board of Prison Directors. Never have I had my preconceived notions concerning any subject matter so completely revolutionized as were those I had previously entertained respecting San Quentin and Folsom prisons. To my surprise I found the work unusually interesting. Problems of the most complex nature, involving every phase of human character, were constantly being presented. It was the newspaper man's "human interest story" multiplied and intensified.

I found a prison population as varied as the number of its units and ranging from the confirmed criminal to the youthful first offender. I found an earnest Board of Prison Directors and a sincere body of prison officials conscientiously performing their duties under conditions that were not encouraging. I found at San Quentin a prison plant far from modern and with cell room intended for about one-third of the prison population. I found somewhat similar conditions at Folsom.

I found the work of the prison authorities criticised upon the one hand by sentimentalists who seemed to think a state prison should be a kind of pleasure resort, and upon the other hand by those who seemed to think that all inmates of a state prison were like so many caged beasts. I found that very few of these well-intentioned but misled people had ever seen either of our state prisons or had acquired any clear or definite knowledge of how they were conducted. I found, further, that the great body of our citizens had but a vague knowledge of the work done at our state prisons and a still more limited knowledge of the modern trend of penological thought.

I became genuinely interested in the work and, in order the better to understand the problems presented and the principles underlying them, I supplemented my

personal experience and observation with the study of such works as I could find relating to prisons and penology. I also attended the several meetings of the American Prison Association and visited a number of state prisons in other states. I also attended the meeting of the International Prison Congress at Washington, D. C., in 1910.

My study, observation and experience led me to the conclusion that parole and the indeterminate sentence are potent and indispensable factors in the successful solution of the problems that confront the state prison authorities.

These problems are complex and difficult. Not until the accused has been convicted of a crime can the state consider him a criminal. Then, for the first time, does he come within the jurisdiction of the state prison authorities. After the home has failed; after the school has failed; after the church has failed; after the juvenile court has failed; after the reform school has failed; after probation has failed; and after organized society has branded him a felon and a moral outcast; then the delinquent is received at the state prison and a final effort made to cure the moral infirmities that have grown and multiplied through the preceding years.

My observation disclosed another fact of tremendous importance, namely, the helplessness of the average prisoner who, at the conclusion of a fixed term of imprisonment, goes out into the world a free man, wholly dependent upon his own judgment, will and resources. He is an "ex-convict"; he has grown unaccustomed to the ways of free people; he is usually without money or friends; a disclosure of his prison service is generally a bar to employment; if he obtain employment, he lives in constant dread of such disclosure or of blackmail levies by former fellow prisoners. And these conditions and difficulties are not only real but they are serious and formidable.

Parole.

This discovery led me to a careful and painstaking study of the parole law passed by our legislature in 1893, but of which little use had hitherto been made. I soon became convinced that here was the remedy for the well-intentioned prisoner who evidenced a real desire again to become a respectable and law-abiding citizen.

I then set about the formulation of an appropriate procedure for the more effective employment of this seemingly helpful and appropriate agency. The board adopted the plan which I presented, which may briefly be indicated as follows:

The prisoner was to make written application for parole, accompanied by a written biographical sketch covering his life from the time of his earliest recollections to the time of his entering prison. The judge who sentenced the prisoner, the district attorney, the attorney for the defense, the sheriff, the chief of police, and other officials connected with the arrest and subsequent proceedings, were to be asked to give their views and to furnish such information as they could. Inquiry was also to be made of employers and others disclosed by the applicant's biographical sketch. An independent investigation was also to be made by the prison officials. Aided by the prison authorities, the prisoner was to secure satisfactory employment and furnish evidence that he had a proper place to which to go. His prison record was to be examined and his conduct while in prison carefully studied. Lastly, he was to be brought before the board and there orally examined. If paroled, the prisoner was to agree not to go into a saloon nor to drink any intoxicating liquor nor to frequent places of immorality or crime. He was to report monthly to the board's parole officer or to such local officer or person as the board might designate. He was also to report monthly his occupation, the number of days worked, what he had earned, and what he had saved. The board's parole officer was to visit the paroled prisoners at their homes and places of employment, keep track of them at all times, and assist and encourage them in their efforts to "make good." To this end, as the work increased, the parole officer was provided with office and field assistants.

The procedure thus inaugurated brought gratifying results. Instead of the untoward conditions faced by the prisoner who suddenly emerges from prison confinement to full freedom and liberty, the paroled prisoner went to certain employment, in a proper environment, and to an employer who knew his status, and where, because of this latter fact, the levy of blackmail was impossible. The paroled prisoner knew he was under surveillance, friendly though it was, and he further knew that any violation of his parole agreement or of any of the rules prescribed by the board for his conduct, meant his return to prison and the loss of his time credits. Thus the paroled prisoner had every incentive to industry, thrift and good conduct. There is nothing more sweet to man than liberty, and the paroled prisoner's liberty depended upon his compliance with the terms of his parole. The result was a period

of adjustment, during which the prisoner could get his bearings and could acquire those habits of conduct that make for good citizenship and right living.

An interesting development accompanied the inauguration of the above procedure. At first some of the applicants, in their biographical sketches, sought to deceive the board respecting matters which the applicant felt might injure his chances for success. The board's investigation, however, invariably disclosed such attempted deception and a denial of the application has invariably followed. It was explained to the prisoner that the members of the board were his friends, but that he must trust them if they were to trust him. That the parole was for the man who had erred, but that it must rest upon mutual candor and confidence. Thereafter, with rare exceptions, the biographical sketches were full and frank and the answers to the questions at the oral examinations were unhesitatingly truthful. As a result, the board, before finally acting upon an application for parole, had, in addition to his prison record, a complete, comprehensive and intelligent knowledge and understanding of the applicant's life, character, habits, occupations and associations, together with the environments to which he had been subjected, his moral and mental training, and all that goes to indicate the presence or absence of desire and ability to lead a correct life.

Parole, as is evidenced by the many law-abiding citizens it has restored to California, is a potent factor in the solution of the second of the above problems (prevent as many criminals as possible from remaining criminals). But it does not, save as a helpful factor, reach the third problem (prevent those remaining criminals from committing crime). The sole solution of this problem is the indeterminate sentence.

The Indeterminate Sentence.

If, as some loose-thinking people seem to think (and the number of loose thinkers appears to be quite numerous)—if, when the gates of a state prison close behind the incoming prisoner all hope for his restoration to law-abiding citizenship is forever gone, then, clearly, he should never be released from prison to prey again upon society. In other words, carrying the theory of these loose thinkers to its logical conclusion, a sentence to state prison of one who has committed a felony should be for life. This would be a simple and easy solution of a grave and complex question. But serious thinkers can not thus lightly dismiss a question so fraught with governmental and social importance and that holds such strong human appeal.

It is, of course, true, as our prison authorities well understand, that some criminals will remain criminals. Like persons afflicted with certain mental and physical maladies, they are incurable. Their criminal tendencies can never be eradicated. With respect to these unfortunates there is but one safe course to pursue—put them where they never again can be a menace to society. And, as we shall see, only through the indeterminate sentence can this be done. It is equally true, and equally well known to the prison authorities, that many prisoners, under appropriate treatment, may be turned back into the great body of law-abiding citizenship. In respect to these two classes of criminals, certain fundamental problems are presented, based upon two incontrovertible propositions. These two propositions are:

(1) No confirmed criminal should ever be turned loose upon society.

(2) No man should be kept in prison beyond that period when, if given his liberty, he would become a law-respecting member of society.

To prolong the imprisonment of the latter works a loss to the state and an irreparable injury to the prisoner. To turn the former loose upon society is a governmental crime. Under our present method of sentencing prisoners to our state prisons both of these things are constantly and unavoidably being done.

How to turn back to society the man who is ready, willing and able to "make good," while restraining the man of fixed criminal habits, is a question that for many years was confined in its consideration to a small circle of thoughtful and inquiring students of criminology. Gradually the question attracted a wider attention, and finally a plan was evolved that met with the approval of those whose study, training and experience best fitted them to judge. This plan involved two problems:

(1) Some mode of determining who should be released (and when) and who should never be released at all.

(2) Some practicable method of procedure for such release and detention.

At the time of his trial and conviction it could not be determined when, if ever, the prisoner would be ready to take his place among the law-abiding citizenship of the State. Nothing short of omniscience could do that. It became clear, then, that this all-important question must be determined after the prisoner's conviction and incarceration. It also became equally clear that there must be no hampering fixed sentence that would compel the release of confirmed criminals. The sentence, therefore, must be indeterminate—that is to say, it must have no fixed period of termination. It should prescribe a minimum period of fixed service to satisfy the punitive demands of society, but no maximum.

Under the indeterminate sentence the procedure (after conviction and imprisonment) would be substantially as follows:

(1) No prisoner would ever be released from state prison except upon parole.

(2) If, and when, the prison authorities concluded that any particular prisoner was ready, willing and able to become an industrious and law abiding citizen, that prisoner would be released upon parole. Proper employment would be found for him and, while kept under surveillance, he would be given friendly aid and encouragement.

(3) Should he violate his parole he would be returned to prison.

(4) If the violation of his parole consisted merely in the infraction of some rule or regulation, or consisted in some act or acts that left open the question of incurable criminal tendencies; and his conduct after his return to prison (continued for a sufficient period) convinced the prison authorities that he should be given another chance; he probably would be paroled again.

(5) If, after an adequate trial on parole, the prisoner demonstrated his fitness for freedom, he would be given his final discharge and he would cease to be a prisoner.

(6) If, however, the parole test disclosed an inability to meet the requirements of free citizenship, the prisoner's sentence would then become one for life.

The principle of the indeterminate sentence has been repeatedly approved by the American Prison Association and it also has the approval of the International Prison Congress, but, so far as I have been able to ascertain, it has never, anywhere, been given full legal sanction. California has taken a preliminary step in that direction, a brief history of which may be of interest to your Commission.

In 1910 the State Board of Prison Directors made a special report to the Governor concerning the establishment of a reformatory for adult first offenders, and with their report transmitted a suggested draft of an act for the establishment and government of such an institution. The board explained in their report that properly to provide for the indeterminate sentence "the entire penal legislation of the state, in so far as it relates to punishment for crime, should be carefully and thoroughly studied and remodeled." Pending such revision and remodeling, however, the board, as a preliminary and temporary step toward the indeterminate sentence, incorporated in their proposed act a section providing that "no judgment, sentence or commitment by which any prisoner is committed to said reformatory, shall fix any term or limit of duration of the imprisonment of such prisoner, but in all such cases the prisoner thus committed shall remain in said reformatory for the maximum length of time prescribed for imprisonment in the state prison for the offense for which he is committed to said reformatory, unless sooner released by the State Board of Prison Directors in the manner hereinafter provided." This provision, in substance, was carried into the act passed by the legislature at the ensuing session of 1911, which act, as already noted, was repealed in 1921.

At its session of 1917 (Stats. 1917, pp. 665 666), the legislature passed an act modeled upon the above provision, but with some substantial changes, and made it applicable to our state prisons. The act of 1917, however, does no more than to transfer from the trial court to the State Board of Prison Directors the power to fix and declare the number of years of imprisonment to be served by the prisoner within the minimum and maximum periods prescribed by existing statutes. But this is not an indeterminate sentence. It is determinate—and not only determinate, but it is actually determined, that is to say, the number of years to be served is fixed and determined by the State Board of Prison Directors, just as it was formerly determined and fixed by the trial court, which term of imprisonment could not then, and it can not now, exceed the maximum number of years prescribed by existing statutes. Indeed, the act of 1917 specifically provides that, "any convicted person

undergoing sentence in either of the state prisons of this state, not sooner released under the provisions of this act, shall, in accordance with the provisions of existing law, be discharged from custody on serving the maximum punishment provided by law for the offense of which such person was convicted."

Under this law confirmed criminals, known by the prison authorities to be such, are constantly being released from the state prisons of California to continue their life of crime. The indeterminate sentence, on the other hand, under proper application and administration, would result in the segregation and permanent confinement of such confirmed criminals.

Briefly stated, the outcome of the indeterminate sentence, thus applied and administered, would be that:

(1) Every prisoner who convinced the prison authorities of his desire and ability to become a law-abiding citizen would be given an opportunity to demonstrate such ability and desire.
(2) No known confirmed criminal would ever be at large.

California is happily circumstanced for the introduction of the indeterminate sentence. The governing body of our state prison is a creation of our state constitution and its stability is thus assured. It consists of five members appointed by the Governor, with the advice and consent of the state senate. The term of each member is ten years, and the respective terms of the several members are so arranged that one expires every two years. Thus the board is always assured of experienced members. These five members serve without compensation. The long term and the opportunity for honorable service attract men of character, ability and public spirit, while the absence of compensation is an effective bar to the ordinary office seeker.

This board, thus constituted, has ever been composed of men of sterling worth possessed of a high sense of duty. Such is the present board, whose members are giving their time and labor freely to the state and are securing results the value of which is little understood or appreciated by the great body of their fellow Californians. And all this under the trying conditions of overcrowded prisons where youthful first offenders are unavoidably subjected to the baleful influence of the confirmed criminal.

This board could safely be entrusted properly and efficiently to apply and administer the indeterminate sentence.

METHODS OF PROSECUTION OF PERSONS ACCUSED OF CRIME

Penologists are agreed that the deterrent effect of punishment lies not so much in the severity of the punishment as in its swiftness and certainty. When a child touches a hot stove the punishment is swift and certain and the deterrent effect is great. If every crime committed in California were followed by swift and certain punishment, our state would see a marked reduction in her prison population. As King Solomon said more than two thousand years ago (Ecclesiastes, 8:11), "Because a sentence against an evil work is not executed speedily, therefore the heart of the sons of men is fully set in them to do evil." In other words, it was Solomon's idea that swiftness and certainty of punishment would lessen the volume of crime.

Swiftness and certainty of punishment depend upon:

(1) Early detection.
(2) Prompt arrest.
(3) Expeditious prosecution.

While recognizing the tremendous importance of "early detection" and "prompt arrest," I am not here expressing any views thereon. Others who have devoted more time and thought to these matters can throw more light upon them than I can. After detection and arrest comes the necessity of "expeditious prosecution," and it is this branch of the subject upon which I propose now to submit a few thoughts.

Prosecutions in California, with rare exceptions, are not expeditious. They are notoriously lacking in expedition. Why?

The reason therefor must be found in the inefficiency of one or more of the following governmental agencies:

(1) The procedure prescribed by statute.
(2) The prosecuting attorneys.
(3) The judiciary.

Procedure Prescribed by Statute.

There has never been a time since California became a state that any lack of statutory requirement made for delay in criminal trials. Trials have lagged, delays have multiplied, postponements have been frequent, but never from any lack of statutory requirement.

Ever since California became a state there has been a statutory provision looking to "a speedy and public trial" for the accused. And our Penal Code has long contained such expediting provisions as the following:

(*a*) After allowing defendant reasonable time to procure counsel, the examination by a committing magistrate "must be completed at one session unless the magistrate, for good cause shown by affidavit, postpone it." (Secs. 859-860-861.)

(*b*) Defendant may have one day to answer the indictment or information. The court may grant further time. (Sec. 990.)

(*c*) Defendant is entitled to five days to prepare for trial. The court may grant further time. (Sec. 1049.)

(*d*) Of course, the court controls the actual trial and the admission of evidence, and can hasten or retard the trial.

(*e*) The court must pronounce judgment not less than two, nor more than five, days after a verdict or plea of guilty. The court has power to extend this time. (Sec. 1191.)

(*f*) An appeal to the Supreme Court may be taken by defendant in open court at time of judgment, or by written notice within two days thereafter. (Sec. 1239.)

(*g*) After hearing the appeal, the Supreme Court must give judgment without regard to technical errors or defects, or to exceptions, which do not affect the substantial rights of the parties. (Sec. 1258.)

This last mentioned provision (Sec. 1258) was carried into the Penal Code in 1872 from the old Practice Act, which was enacted in 1851 (over three-quarters of a century ago) at the first session of the California legislature after California's admission into the Union. It has always been a part of the law of California.

These are but typical of our statutory provisions governing criminal procedure. It will be observed that these provisions make for expedition and for a disregard of technicalities that do not affect substantial rights. Cases may arise, and sometimes do arise, where the rigidity of the statute might work an injustice. To meet situations of this character the statutes give to the courts a discretionary power to grant postponements, extensions of time, and the like. And right there will be found the seat of the trouble. Our statutory procedure is alright, and always has been alright. The trouble lies in the abuse of judicial discretion.

In the very nature of things it is impossible in a statutory enactment to foresee, and to make provision for, all the multitudinous contingencies that may arise along the way in a criminal proceeding. Of necessity, much must be left to the wise and prudent exercise of judicial discretion. And if this discretion be abused the blame therefor can not be laid at the door of statutory enactment.

Prosecuting Attorneys.

There probably have been, and probably will continue to be, district attorneys who keep a constant finger on the public pulse and who do only those things which they believe will advantage them politically. I may say, however, that I have had some opportunity for observing the district attorneys of California, and my belief is that a large majority of them are faithful to their trust. And even the unfaithful could do but a modicum of harm if faced by an honest, an able, and a fearless judiciary.

The Judiciary.

And now we come to the very heart of the trouble. It is an unpleasant thing to say, but it is true, and the bar of California knows it to be true, that however honest our trial judges may be, a majority of them, particularly in our more populous centers, are neither able nor fearless. Too many of our trial judges have reached the bench through skillfully conducted campaigns, with appeals to the popular local sentiment of the day, and in entire disregard of those sterling qualities and qualifications that go to make up the able and the fearless judge. Most of the judges of whom we are now speaking made a rather poor fist of practicing law, and they look forward with dread to political defeat and a return to a reliance upon their own

meager abilities. With the recall stalking beside them and election day looming ahead, these judges give their waking thoughts over largely to avoiding the one and successfully meeting the other. Their judicial labors become secondary and subordinate to their political activities. Such judges are more concerned with the effect their judicial conduct may have upon their political fortunes than they are with the expedition of criminal trials. I know this sounds harsh, and I wish it were not true. But if we are to apply an efficacious remedy we must have a correct diagnosis based on facts.

It is perfectly clear that our statutory procedure invites and permits the expedition of criminal proceedings. It is equally clear that neither prosecuting attorneys nor defending attorneys could unduly retard such proceedings without the aid or acquiescence of the trial judge. The conclusion is, therefore, inescapable that lack of expedition in criminal proceedings must be charged to a timid and politically-minded judiciary. The remedy is obvious. If we are to have expedition in criminal proceedings we must have able and fearless trial judges. But how are we to procure such judges. That is the real problem.

This problem has been successfully solved in England, and the manner of its solution there may be worthy of careful study here. The trial judges there are appointed for life with salaries equivalent to about $25,000 a year in our money. The office is there considered one of high and exceptional honor and the appointments thereto are made from the recognized leaders of the English bar. For this the bar itself is largely responsible. The spirit of the bar that fosters the selection of its ablest members was of gradual growth, but is now a definite and permanently controlling factor. The political party in power heeds the views of the bar and the bar invariably puts forward its ablest members. Indeed, it has reached a stage where prediction can safely be made that, should a vacancy immediately occur, one of not more than a dozen known and recognized leaders of the bar would be appointed to such vacancy.

Such is England's method of filling judicial positions in her trial courts, and the result is an honest and able and a fearlessly independent judiciary. Criminal trials are there conducted with notable fairness and with prompt expedition. No social, political, or other standing of the defendant has any effect upon an English trial judge. Lords and laborers, prime ministers and chimney sweeps, all look alike to him. His sole guide is the law as applicable to the facts of the case before him.

For the last quarter of a century in England there has been a steady annual decrease in the number of persons committed to penal servitude (corresponding to commitments to our state prison) and it is believed by those most capable of judging that this has resulted in no small degree from the certainty of an early and an expeditious trial of every criminal charge. In California, on the other hand, there has been a startling annual increase in the number of persons committed to our state prisons, whose population on January 1, 1928, had reached the appalling number of 7774.

I think it may safely be assumed that the bar of California would welcome an opportunity to aid in the selection of able and fearless trial judges. Under present conditions, however, the effectiveness of such aid would be greatly minimized. The ablest members of the bar stand aloof from a judicial office whose possession involes a political scramble, where the glad hand overwhelms merit, where an appeal to passion and prejudice outweighs considerations of judicial fitness, and where uncertain tenure and a reduced income would be the rewards for their success at the polls. The truth is that, with a rare exception now and then, the field from which judicial candidates can be selected for our trial courts, at least in the more populous centers, is limited to lawyers of meager ability who are actuated by no higher motive than to secure through the medium of the bench an income they could never hope to earn in the practice of their profession. Rarely within this narrow field can there be found an able and a fearless judge. And without able and fearless judges we can never have that expedition in criminal proceedings that makes for the deterrent qualities of swiftness and certainty in the infliction of punishment for crime. We are thus forced to the conclusion that until we can find and adopt some practicable and effective method of securing able and fearless judges to preside over our trial courts, we shall continue to suffer from the inefficient administration of our criminal laws.

It seems to me, therefore, that when your commission comes to a consideration of "Methods of prosecution of persons accused of crime," it may well devote itself with painstaking care to an exhaustive study of the means whereby California may be assured of an able, a fearless and an independent judiciary.

Permit me to say in conclusion, and by way of epitome, that, without minimizing the importance of the many questions not here discussed, I feel that your commission may wisely give serious thought and consideration to California's judiciary, with special reference to her trial courts, to the establishment of a reformatory for adult first offenders, and to the matter of a full legal recognition of the indeterminate sentence.

I had not contemplated writing at such length, but the gravity of the questions discussed, their importance to California's future welfare, and my intense interest therein, have led me into a more detailed elaboration of them than I had intended.

Crime conditions in California have reached a most unsatisfactory stage, and they are growing worse. These conditions are calling loudly for the overhauling of our governmental agencies that deal with the prevention and suppression of crime. A great task and a mighty opportunity now confront your commission. That they will ably perform this task I have no doubt, and I shall be pleased if what I have here written shall in any degree be of assistance to them in the great work they have undertaken.

Very truly yours,

(Signed) TIREY L. FORD.

Recommendations of Judges J. J. Trabucco and Fred V. Wood

OAKLAND, CALIFORNIA, April 31, 1928.

California Crime Commission.
1704 Tribune Tower,
Oakland, California.

GENTLEMEN: We offer for consideration a few suggestions for a somewhat radical change in dealing with the crime of murder in this state.

Our present laws in their application have perpetrated the most gross and glaring injustice and inequality. Murderers of the most dangerous character have escaped with life sentences, while in other instances killers in reality guilty only of manslaughter or second degree murder have been sent to their death through a technical finding that they had formed a deliberate and premeditated intent to kill "in the twinkling of an eye" before the mortal blow was struck.

Our present laws are an unfortunate compromise between the advocates and the opponents of capital punishment. Many an unfortunate man has been executed, where grave doubt has existed as to his guilt of murder of the first degree while the more fortunate killer, who may have committed an unquestioned and aggravated murder of the first degree is sentenced to life imprisonment to be released in a few years under the provisions of our parole law.

It is almost a truism that in the absence of a strong public sentiment, an accused person defended by adroit and experienced counsel will escape the death penalty, while the less fortunate accused one is too often unjustly executed because of prejudice of the community or lack of assistance of able counsel.

The records for the past few years in most of the counties of our state are replete with instances of incongruous punishments for murder.

In our opinion there is little hope of improvement if we continue to invest the full power of life and death in a jury of men and women, inexperienced in law and trials, selected by chance, laboring under emotion, swayed by sympathy or passion, often with an imperfect understanding of the distinction between the degree of murder and manslaughter, hoodwinked at times by attorneys, and frequently dominated by a few of the stronger characters on the panel. Many jurors with whom we have conversed believe that the penalty should be determined by the court.

There is an increasing reluctance upon the part of state executives to commute death penalty sentences to life imprisonment, based upon the fact that the sentences have had the final approval of the courts, whereas in fact in some cases the justices of the supreme court and the trial judge have felt that there were abundant circumstances in mitigation of the supreme penalty.

Under the system we propose, the power of life and death is taken out of the hands of the jury and committed entirely to the seven justices of the supreme court. The fate of the accused will be determined with due deliberation, justly, fairly without the influence of prejudice or passion in accordance with the law and with uniformity throughout the state. The justices will also be furnished with the

sentiment of the jurors as to the penalty, as well as the opinion of the trial judge as to the extenuating circumstances, if any.

We also recommend that no person committed to state prison for murder of the first degree shall be eligible to parole, and further that no pardon shall be granted to such a person without the consent of a majority of the justices of the Supreme Court. In our opinion, if punishment is to work as a deterrant of murder, life imprisonment must mean confinement in state prison until death.

We also suggest an amendment to section 189 of the Penal Code by adding the words "in cold blood," following the words "or by any other kind of wilful, deliberate and premeditated killing."

It is the practice of trial judges doubtless without exception, to charge the jury, "That there need be no appreciable space of time between the intent to kill and the act of killing. They may be as instantaneous as successive thoughts of mind." We believe that this instruction sometimes confuses the minds, of the jurors as they hear it read, and causes them to lose sight of the fact that there must be deliberation, premeditation and reflection to constitute murder of the first degree. We have suggested the phrase "in cold blood" as it is an expression well known and understood by the lay mind, and less likely to cause confusion than the phrase "sedate mind," as used in the state of Texas.

We believe that the minimum punishment for murder of the second degree should be changed from five years to ten years, as the law provided for many years prior to 1927. It is difficult to imagine a case where the ends of justice is subserved by an imprisonment for less than ten years.

We think that the plan we have proposed, if thoroughly understood, will meet with the approval of good citizens, whether opposed to or in favor of capital punishment.

The great desirderatum is to impose a penalty justly and fairly that shall be a deterrent to others.

In the past twenty years or more in this state it can hardly be said that murder has been punished by either the death penalty or life imprisonment.

Sporadically the extreme penalty has been inflicted, but too often unjustly, and as for life imprisonment, the parole laws have made it a meaningless phrase.

We submit our recommendations in the confident belief that if adopted it will tend to reduce the number of murders and that the law will be administered humanely with justice, impartiality and uniformity throughout the state.

We enclose copies of sections 189 and 190 of the Penal Code as we would have them amended.

Yours very truly,

(Signed) FRED V. WOOD,
Judge of the Superior Court of
Alameda County.

(Signed) J. J. TRABUCCO,
Judge of the Superior Court of
Mariposa County.

Section 189. Degrees of Murder.

All murder which is perpetrated by means of poison, or lying in wait, torture, or by any other kind of wilful, deliberate, and premeditated killing, in cold blood, or which is committed in the perpetration or attempt to perpetrate arson, rape, robbery, burglary, or mayhem, is murder of the first degree; and all other kinds of murders are of the second degree.

Sec. 190. Penalty for murder. Persons under eighteen years.

The punishment for murder of the first degree is death, but the Supreme Court on appeal shall mitigate the punishment to life imprisonment in State Prison when in its judgment there are extenuating circumstances to warrant it, and the verdict of the jury shall specify the number of jurors, if any, recommending life imprisonment. The trial judge not later than ten days after the filing of the record on appeal shall mail to each Justice of the Supreme Court a certificate, stating whether there are any extenuating circumstances and the nature of the same, if any. Upon the plea of guilty the trial court shall determine the degree, and may mitigate the punishment of murder in the first degree to imprisonment for life where extenuating circumstances justify it.

Every person guilty of murder in the second degree is punishable by imprisonment in the State Prison for not less than ten years, provided, however, that the death penalty shall not be imposed or inflicted upon any person for murder committed before such person shall have reached the age of eighteen years; provided, further, that the burden of proof as to the age of said person shall be upon the defendant.

Communication from Clarence F. Lea, Congressman, First District, California

January 23, 1928.

California Crime Commission.
Chris B. Fox, Secretary.
Tribune Tower,
Oakland, California.

Gentlemen:

Your letter of December the second addressed to me at Santa Rosa has been forwarded here for reply. A most important study has been committed to you. I wish I were at liberty to give the time to the problem in order that I might be of some possible assistance.

Common prevalence of crime is one of the most disappointing products of our success as a nation. We are abnormally out of line with the old progressive nations of the world. There must be some very concrete and important reasons for the excess of crime in this country. It is reasonable to suppose there are some fundamental reasons to account for the moral deterioration or laxity producing these results. It is also true there are probably many concrete illustrations of the fundamental trouble involved.

One big question is, "What is there in our society that produces this abnormal number of criminals?"

In the main, I believe crime comes out of mental deficiency or a moral deficiency of character. I believe the moral deficiency is the primary of these two causes. That leads us into a consideration of the moral, religious, economic and social makeup of the country. Conclusions drawn in this field must necessarily be more or less susceptible of doubt and incapable of that concrete demonstration we naturally seek in attempting to solve this problem. These moral considerations are perhaps beyond the purview of your investigation.

Other questions are, "How can we better enforce the law to prevent and apprehend crime?" "Wherein can our system of crime detection be improved consistent with American principles of justice?" "How can we improve the personnel and cooperation of our peace officers?" "What is required to improve our court procedure retaining the necessary legitimate safeguards of the accused and yet give prompt and effective expression to the law against crime?"

Our preventive and corrective methods for crime doubtless need improvement. We need a system of training and selecting peace officers and detective forces that will give greater efficiency to the apprehension of criminals. The recent Hickman case demonstrated a high efficiency in some respects of our peace officer system and a low efficiency in others, that characterize our present system. The greatest possible urge to diligence existed in his case, yet he passed through the hands of peace officers in several specific instances and traveled in a tell-tale auto with suspicious speed upon our main highways for fifteen hundred miles before he was apprehended. There was a manifest lack of skill in his apprehension. Could we not expect a greater efficiency in our peace officer system? The question is, "How could this system and its personnel be better improved?" This involves selection, training, retention of the efficient and the discarding of the inefficient.

The peace officers find it necessary and desirable to make inquisitorial efforts against accused persons in order to secure confessions and admissions that contribute to the establishment of the crime and identification of the accused. No man familiar with our system of criminal apprehension can doubt that it is the duty of our peace officers to make these attempts, with due regard, however, to the legitimate rights of the accused. This practice prevails without much legal sanction and, no doubt, frequently by the use of methods which can not be commended.

I believe the time has come when it may be seriously asked if society is not justified in attempting to give more legal sanction to these efforts to compel disclosures from the defendant and at the same time give proper humane and legitimate safeguards to the accused. There are many cases in which we can, without injustice to the legitimate rights of the accused, require him to speak or testify, or suffer the legitimate conclusions that can be drawn from such refusal.

Then there is that broad field of injury as to the treatment we should accord the guilty. To what extent and how can we help promote the return of the criminal to useful citizenship without breaking down the certainty and wholesome

example of punishment? How can we make the example of punishment more impressive in deterring the commission of crime? Self-protection, fear of punishment, and the desire to avoid ill consequence to ourselves as a result of our own misconduct, are still among the strongest motives of the human race. To what extent these motives operate in restraint of criminal impulses largely depends on the criminal's judgment as to the probability of his detection and the certainty and adequacy of his punishment. The egotism of the criminal frequently leads him to under-estimate the probability of his detection. He is proportionately unrestrained against the commission of his crime through his own egotism.

No system of law administration can eliminate the criminal's egotism that misleads him, but a law administration and enforcement that moves with promptness, efficiency and certainty can greatly increase the deterrent effect of our punitive system.

The deterrent effect of convictions in many serious cases are largely nullified, in my judgement, by the long time that elapses between the commission of the crime and the final imposition of the punishment. Any changes in our law or practice that will bring the criminal to trial promptly, prevent unnecessary appeals, and lead to the prompt disposition of appeals, should be helpful. I believe that something slightly less than the unanimous verdict of the jury should be required.

Any changes in the law proposed should not lose sight of the necessity of retaining in every step of our procedure the element of inherent fairness. Fairness is just as important an element as vigor in securing the best results in criminal prosecutions.

I do not join in the cry for excessive punishment as a curative for crime. I regard the speed and certainty of punishment as more important features.

The multiplicity of crimes created by our legislative bodies, many of them trivial transgressions involving no moral wrong, have become a menace to our institutions. Creation of crimes, not found on a background of moral offense, result in needless annoyance and interference of citizens, create distrust and disregard for law and the justice of the law.

True law obedience comes out of affection and reverence for government, confidence and judgment in the wisdom of its policies. When we break down the citizen's confidence and respect for its wisdom and policies, we not only weaken him as an element for the support of law but we create an indifference or active support of law disobedience.

The imposition of excessive penalties defeats the purposes for which imposed, and helps break down all law enforcement. The penalty must suit the crime. This is elementary to successful law enforcement. Distorted penalties simply bring the law into contempt and nullify enforcement efforts. Wise legislation is the beginning of successful law enforcement. Foolish legislation is the beginning of the disregard of law and the break down of enforcement. The laws and their method of prosecution and enforcement must conform to the judgment of the average type of good sane Americans or else we have failure.

After all is said and done, the true foundation for law obedience and crime prevention, begins with the individual citizen. The bulwark against crime should begin in the home with the child and follow him in the school. We must develop more affectiton for our country and its institutions, more respect for the rights of others, a less disposition of the government to unnecessarily interfere with the rights of the individual. In other words, we must develop a wholesome, positive, broadminded citizenship, moral but not puritanical, positive but not tyrannical, conscious of duty as an individual and conscious of duty on a jury, earnest in prosecution but just, certain in punishment, neither flabby with leniency nor cruel with severity.

The limited time at my disposal for this letter has made it general in terms and I fear leaves it of little, if any, concrete aid to your Commission.

Sincerely yours,

CLARENCE F. LEA,
Congressman, First District.

Communication from O. K. Cushing

March 2, 1928.

Hon. James A. Johnston,
Chairman, California Crime Commission,
Tribune Tower,
Oakland, Cal.

Dear Sir:

Reply to your favor of January 7th asking what, in my judgment, are the best measures to be taken, either by legislation or otherwise, to improve the administration of criminal justice and reduce crime in California, has been delayed by other demands upon my time.

The following suggestions are respectfully submitted:

While there is much criticism with respect to "the law's delay" in punishing crime, I am inclined to think much less of the blame can be properly attributed to that source than is generally supposed by the public. I think that if complete information were available it would show that most criminals escape punishment by not being caught at all. If this be correct the remedy, in so far as the remedy can be applied by law, would be in some way to strengthen the police departments.

After the criminal is caught the most important thing is that punishment be administered promptly. Amendments to the Penal Code were adopted in 1927 designed to make criminal trials and appeals more speedy and I think the amendments will have that effect. The Judicial Council, of which the Chief Justice of the Supreme Court is chairman, has the power so to direct the work of the courts as to take full advantage of these amendments so far as the courts are concerned.

It seems to me that the law might be made to provide for general supervision and direction of the work of the district attorneys by the Attorney General so that by appropriate supervision he could see that no delay is occurring anywhere else along the line.

The press, in telling us of crime, so often mentions the fact that the person arrested is on probation or parole that it is evident that the administration of the probation law and the indeterminate sentence law may require further attention.

Those convicted of crime undoubtedly try to divert the probation law from its original purpose so as to use it as a means of escape from justly deserved punishment. On the other hand, I think it very likely that probation officers are often given more work than they can properly perform with a consequent breaking down in the operation of the law. The law, as you know, provides for paid and unpaid probation officers. It should not be difficult to secure the service of public-spirited men and women who would act as unpaid officers in sufficient number that every person released on probation would be under the close supervision of a probation officer. The requirements can hardly be made too stringent in this respect. A person on probation should be made to realize that probation is exactly what it means. He should be required to report so frequently to the probation officer that if he departs from the path of proper conduct it will be known almost immediately. On the other hand, the probation officer should be expected to keep so well informed concerning the lives and habits of persons under his charge that there would be in this manner a double check on their activities. In other words, the person on probation should be made to feel that the slightest step from a line of proper conduct will immediately bring him before the court for punishment under the suspended sentence and at the same time that in the probation officer he has a friend to whom he can turn for counsel and advice. The force of paid probation officers should be made sufficient to enable the officers to make the most complete investigation with respect to every one applying for probation so as to prevent abuses in that direction. I think there should be some administrative body to whom all probation officers should be required to report frequently so that the whole probation system would be under constant supervision and that needed changes in the system and amendments in the law could be brought about.

The present indeterminate sentence law leaves to the Board of Prison Directors the duty of determining when prisoners in the state prisons shall be released on parole. I think this puts too onerous a duty upon that board. The theory of the indeterminate sentence law is that no person shall be released upon parole until he is fit for such release and that no person shall be detained in prison after he is fit for release on parole. The provisions of our law are such that it can not operate to the full extent of this theory, and perhaps in that respect it should not at present be changed; but we know that many men who are released on parole

return to crime. No man should be released on parole until a suitable position is found for him. He should then be placed under the supervision of a parole officer whose duty it should be to keep such close track of him as to be sure that he is attending to his business and not engaging again in criminal practice. To carry this theory into practice I think would require a parole board, separate from the Board of Prison Directors, that would give much time to the work, and also a sufficient number of parole officers to supervise to the full extent necessary the men released upon parole. If the theory could be fully carried out no man would be released except upon parole and only when the board finds him fit for parole, and then only when employment has been found for him so that he can immediately go to work. By this procedure he would be protected on parole from blackmail by those who had known of his criminal career, and having steady employment would be less subject to temptation to again embark on a course of crime—two difficulties that confront every man discharged from prison. The supervision of the parole officers should be close and constant enough to enable them to know that men under their charge are at all times where they ought to be. The man on parole should be so dealt with that he will understand that so long as he demeans himself properly he has a friend in the parole officer; that the slightest disregard of the provisions of parole will cause his return to custody and that he will not be released from parole until it is shown as satisfactorily as can be shown that he can safely be trusted to lead a life of rectitude.

The changes above suggested with respect to the probation and parole laws will be expensive, but the State can not expect to repress the crime wave without cost.

One question that has been much discussed at the bar and in the press is that of permitting judges to instruct juries on questions of fact, now prohibited by the constitution. The people seem unwilling to trust their judges in this respect. The judges of the United States courts have this power. By denying the power to the judges of our state courts we prevent the man from whom the jury must take the law from giving to the jury his views regarding the facts. Thus the only expert trier of cases in the courtroom is compelled to keep silent on the very thing concerning which the public wishes to be informed. This does not seem wise. The judge decides the facts in every case tried without a jury and it is not proposed to take away from the jury the power to decide the facts; but only to give the jury the benefit of the judge's views. The law can be so framed as to require the judge to instruct the jury explicitly and emphatically in express terms that they are the absolute judges of the facts and that they are not bound by what he says about the facts. This is a subject as to which there is much difference of opinion and it should be carefully considered. It was quite fully discussed at the 1926 meeting of the California Bar Association, as shown on pages 162 to 185 of the Association's report for that year. The meeting favored the proposed change by a narrow margin. The question was the subject of much debate in the constitutional convention of 1879.

The average newspaper account of a crime that arouses public interest too often makes a sort of hero or person of dramatic interest of the criminal. The newspapers are under much difficulty in dealing with this problem. They sell news; the public wants to buy it and is entitled to it and evidently likes it racily written, but it does seem that the press might give some assistance in this direction, and with public approval. For example, Hickman, recently convicted of an atrocious crime in Los Angeles, referred to himself in communications he wrote before the crime was committed as "Fox." The newspapers have constantly so described him in large headlines which undoubtedly appealed to the qualities of egotism that led him into criminal life. Every criminal is an egotist and criminals like this sort of distinction. Reference has been made, here and there, since his crime was committed, to other criminals who, following his example, have designated themselves as "Fox." The word fitted well into headlines and undoubtedly was used sometimes for this reason, but the less the newspapers do to make the criminal appear to be capable or able or dramatic the more helpful it will be in the administration of the law.

Finally, it seems to me that one thing greatly needed which can not be reached by legislation is the development among the people of more respect for the law. The American people are too much disposed to regulate matters by law without informing themselves as to what the law can and can not do. This results in putting undue strains upon the law. After all, law enforcement is a matter that can best be developed by encouraging general respect for the law and the rights of others. Those who support the prohibition law, on the one hand, and buy

liquor from the bootlegger, on the other, are cultivating in their children a disrespect for the law that will be hard to eradicate. The man who regards it as his right to drive his automobile beyond the speed limit and feels that he has paid for the privilege by paying a fine is another who breeds disrespect for the law. The State can punish and discipline its citizens for infractions of the law, but the citizen himself is the only one who can really prevent infractions. The State can punish the driver who violates the law regulating speed of automobiles, but the driver himself is the only one who, so far as he is concerned, can *prevent* its violation.

The constitution of the United States should be intensively studied in our schools and the youth of the country should be taught, more effectively than they are today, that he falls far short of his duty who fails to acquaint himself with his country's problems or fails to vote at elections.

In conclusion, may I say that the members of the Board of Governors of the State Bar are disposed to do everything they can in the administration of the new law organizing the State Bar to help in the solution of this problem.

I shall be glad if in any way I can at any time be of assistance to the Commission.

Yours very truly,

(Signed) O. K. CUSHING.

Communication from O. H. Snedigar

OAKLAND, CALIFORNIA, February 1, 1928.

Mr. Chris B. Fox,
Tribune Tower,
Oakland, California.

My Dear Fox:

I appreciate your invitation to attend the session of the Crime Commission on Friday, February 3, 1928, and am sorry I will not be able to do so. I am sending you, however, in this letter certain suggestions relative to criminal procedure which have crystallized in my mind during an experience of several years as probation officer of this county.

1. **Delay in Bringing Defendants to Trial.** In spite of legislation had from time to time for the express purpose of eliminating unnecessary delays, defendants are still able to secure long continuances before coming to trial. My observation has shown that long delays often operate to handicap the prosecution and the administration of proper justice. No objection is had to continuances, the refusal of which would prejudice the defendant. There are cases, however, where continuances are sought for the sole purpose of delay. The interest of complaining and other material witnesses for the prosecution wanes. Essential facts which could be testified to with exactness and certainty while fresh in the minds of witnesses become confused and uncertain in their memories. Important details are sometimes forgotten altogether. Especially is this true of witnesses who are minors. I have observed also that prosecution officials sometimes lose interest through long delays and do not prosecute with the same zeal that would have been shown were immediate trial held.

2. **Jury System.** The fallability of juries is, I think, well recognized. Justice often miscarries because juries bring in verdicts directly contrary to the evidence presented. This deplorable situation probably arises from two main causes: (1) lack of intelligence on the part of jurors, (2) sympathetic reaction to emotional appeals made by defendants and their attorneys.

If juries could be trained for jury duty the first cause could be greatly eliminated. It is probably impractical to specially train a group of citizens in the community for this important work but it would seem to me, unless there are objections which I do not know, that those citizens on the jury list could be required to pass an examination designed to test their general intelligence, judgment and emotional stability. A defendant would then be assured of his constitutional right "to trial by a jury of his peers," which I fear is not always the situation under our present system.

As to the second cause: If defendants and their attorneys could be restrained from wandering so far from the main issue into the field of human emotions and be limited to a presentation of the facts of their defense to the minds of juries rather than to their hearts, I am sure the ends of justice would be more often served. Under our present system there seems to be no limit to which attorneys

may go in their argument. Rather than being a privilege allowed for the purpose of summing up the evidence it has become an opportunity for the use of oratorical ability to sympathetically sway the minds of jurors from the course designated by logic and reason.

3. **Expert Testimony.** Expert testimony is, I believe, invaluable in many cases. The practice, however, of allowing both prosecution and defense to put on experts of their own choosing often results in hopeless perplexities in the minds of jurors. Most important facts, provable only by expert testimony, are supported on one side by one group of experts and contradicted by an equally credible group on the other.

Medical men, alienists, psychologists, psychiatrists, handwriting experts and others seem invariably to testify in favor of the side which calls them. The result can not be other than to confuse juries and to bring expert testimony into disrepute. To my mind the value of this type of testimony is great and should not be restricted but I believe the judge of the court, at the request of either party or upon his own volition, should determine and call those witnesses who are to give such testimony. I feel that if this practice could be had, expert testimony would be a real aid in criminal trials, which is not always the case under our present system.

4. **Probation.** The principle underlying the probation system is sound but I am doubtful of its application in many cases. It should never be granted without the utmost consideration being given to all the factors concerned and only in such cases where it is certain the ends of justice will be best served thereby.

Probation offers a real opportunity for the reformation of the deserving defendant, with resulting advantage to the State. The consequences that follow where this privilege is extended under doubtful circumstances are often disastrous both to the probationer and to the community.

The discretion and judgment of courts, the basis upon which probation is granted or refused, are of course incapable of standardization but it seems that a more or less general policy could be adopted that would make for more uniformity in the matter of probation. Insistence on a detailed and thorough investigation in the case of every applicant for probation would in a great measure accomplish this end. I am informed that this procedure is not always followed.

I feel that the standard of probation officers should be kept on a high plane. Their responsibility to the State and to the probationers under their care is grave and they should be qualified to meet it.

I belive that probation officers should be appointed only after thorough examination has demonstrated their fitness for the position. Provision should be made that such examination be standardized and be statewide.

Scientific Study of Criminals. I believe that provision should be made for a scientific study of every convicted felon in the State of California, such study to be made by men trained in the science of human behavior, its causes and its probable reaction to punitive and reformative measures. I have no hope that we will ever solve the crime problem until we begin to determine causes and apply measures to eradicate them. Our present system of dealing with symptoms alone is so unscientific and unintelligent that no lasting or permanent amelioration of the crime situation can ever be had from it. I believe that studies of criminals for the purpose of ascertaining causes of known conduct and prognosing future conduct will be of more value in the solution of the crime problem than any other measure that could be adopted.

Respectfully yours,

O. F. Snedigar,
Probation Officer, Alameda County.

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View Showing Traffic on State Highway Near Santa Monica

DEPARTMENT OF PUBLIC WORKS
STATE OF CALIFORNIA

DIVISION OF HIGHWAYS

Sixth Biennial Report

OF THE

Division of Highways

TO THE

Director of the Department of Public Works

B. B. MEEK, Director

C. H. PURCELL, State Highway Engineer
and Chief of the Division

Constituting also the
BIENNIAL REPORT
of the
CALIFORNIA HIGHWAY COMMISSION

RALPH W. BULL, Chairman
J. P. BAUMGARTNER M. B. HARRIS
FRED S. MOODY JOSEPH M. SCHENCK



LETTER OF TRANSMITTAL

Hon. C. C. Young,
Governor of California.

In accordance with the duty imposed upon me by the statutes under which the Department of Public Works is organized, I am herewith transmitting to you a report covering the transactions and activities of the Division of Highways and the Division of Contracts and Rights of Way for the biennium ending June 30, 1928. In other volumes will be found the reports of the Division of Water Rights, Engineering and Irrigation, and Architecture, and Ports, constituting together the report of the Department of Public Works.

In transmitting this report, let me express my appreciation of the great help that you have been to the department, and of the value of your counsel and advice in solving problems that have confronted us.

I desire also to take advantage of this opportunity to express my appreciation of the service of the members of the California Highway Commission. Their duties have been always exacting and, in many instances, most arduous. Serving the state without compensation to themselves, they have given of their time and their ability in a manner that constitutes an outstanding example of unselfish devotion to the public weal.

Respectfully yours,

B. B. Meek,
Director.

Sacramento, California,
November 1, 1928.

LETTER OF TRANSMITTAL

Hon. C. C. Young,
Governor of California.

We herewith transmit to you the Sixth Biennial Report of the California Highway Commission.

In transmitting this report we wish to express our thanks for the uniform consideration and the many courtesies extended to the members of the Commission by yourself, by B. B. Meek, director of the Department of Public Works, by C. H. Purcell, State Highway Engineer, and by all those connected with the work.

CALIFORNIA HIGHWAY COMMISSION,
Ralph W. Bull, Chairman,
J. P. Baumgartner,
M. B. Harris,
Fred S. Moody,
Joseph M. Schenck.

Sacramento, California,
November 1, 1928.

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STATE OF CALIFORNIA

DEPARTMENT OF PUBLIC WORKS

DIVISION OF HIGHWAYS

C. H. PURCELL, Sacramento, State Highway Engineer and Chief of Division of Highways.

HEADQUARTERS STAFF

Public Works Building, Sacramento

T. E. STANTON—Materials and Research Engineer
FRED J. GRUMM—Engineer of Surveys and Plans
CHARLES S. POPE—Construction Engineer
CHAS. E. ANDREW—Bridge Engineer
T. H. DENNIS—Maintenance Engineer
R. H. STALNAKER—Equipment Engineer
G. T. McCOY—Administrative Assistant
L. V. CAMPBELL—Office Engineer
E. R. HIGGINS—Chief Accountant
HARRY McCLELLAND—Right of Way Agent

DISTRICT ENGINEERS

I. Chas. H. Whitmore—Eureka
II. H. S. Comly—Redding
III. F. W. Haselwood—State Office Building, Sacramento
IV. Jno. H. Skeggs—State Building, San Francisco
V. Lester H. Gibson—Bank of Italy Building, San Luis Obispo
VI. E. E. Wallace—Fresno
VII. S. V. Cortelyou—Associated Realty Building, Los Angeles
VIII. E. Q. Sullivan—San Bernardino
IX. Francis G. Somner—Bishop
X. R. E. Pierce—State Office Building, Sacramento

STATE OF CALIFORNIA

CALIFORNIA HIGHWAY COMMISSION

RALPH W. BULL, *Chairman*—Eureka
J. P. BAUMGARTNER, *Commissioner*—Santa Ana
M. B. HARRIS, *Commissioner*—Fresno
JOSEPH M. SCHENCK, *Commissioner*—Los Angeles
FRED S. MOODY, *Commissioner*—San Francisco

SECRETARY

E. Forrest Mitchell—Belvidere

ATTORNEY

Harry A. Encell—San Francisco

PAST MEMBERS OF THE CALIFORNIA HIGHWAY COMMISSION

Name	Residence	Date of appointment	Termination of membership
Burton A. Towne	Lodi	August 2, 1911	Resigned Jan. 14, 1914
Charles D. Blaney*	Saratoga	August 2, 1911	Resigned March 1, 1917
N. D. Darlington	Los Angeles	August 2, 1911	Resigned Jan. 8, 1923
Charles F. Stern	Eureka	Jan. 15, 1914	Resigned Dec. 21, 1918
Henry J. Widenmann*	Vallejo	March 1, 1917	Died Oct. 6, 1918
Charles A. Whitmore	Visalia	Nov. 29, 1918	Resigned Jan. 8, 1923
Emmett Phillips*	Sacramento	Dec. 21, 1918	Died June 18, 1919
George C. Mansfield	Oroville	June 24, 1919	Resigned Jan. 9, 1923
Harvey M. Toy	San Francisco	Jan. 9, 1923	Resigned Jan. 3, 1927
Louis Everding	Arcata	Jan. 9, 1923	Resigned Jan. 17, 1927
Nelson T. Edwards	Orange	Jan. 10, 1923	Resigned Jan. 3, 1927

* Deceased.



Mono Lake from the State Highway in Mono County.

REPORT OF THE STATE HIGHWAY ENGINEER

HONORABLE B. B. MEEK,
Director of Public Works,
State of California.

SIR: A steady and systematic progress in all phases of state highway activity has continued through the biennium ending June 30, 1928.

New laws going into effect during this period which are of primary importance to highway activities include the one-cent gas tax for new construction, the act classifying state highways, and the act reorganizing the California Highway Commission and creating the Division of Highways as a division of the Department of Public Works.

The subject of new laws is discussed by the Chief of the Division of Contracts and Rights of Way.

ORGANIZATION

The work of the Division of Highways is naturally divided into several distinct lines of activity as herein indicated:

Materials and Research,
Surveys and Plans,
Construction,
Bridges,
Maintenance,
Equipment,
Accounting,
Headquarters office,
Right of Way.

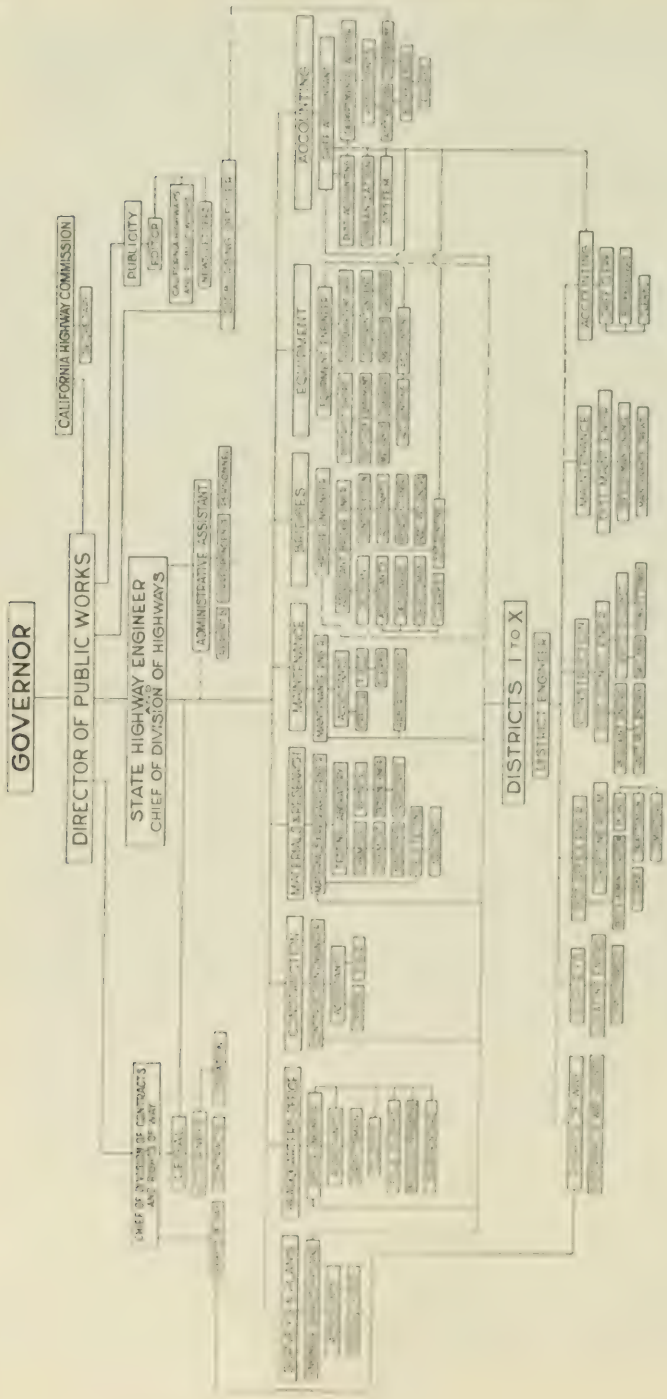
Each of these activities is handled by a separate department in the Division of Highways, with the exception of right of way which is under the supervision of the Division of Contracts and Rights of Way. As pointed out in the Fifth Biennial Report, an organization of this type permits of specialization along each line of work and also when combined with the proper contacts between the several departments enables the work of the entire division to proceed as a unit.

OVERHEAD EXPENSE

The costs of administration and engineering have been maintained to the minimum consistent with an orderly and businesslike administration of highway activities. Greater attention is being given to planning highway work several years in advance, preparing careful estimates for budgets and preparing complete engineering data prior to advertising work for contract.

REVENUES AND EXPENDITURES

The revenues for highway purposes during the past two years amounted to $38,589,064.13. During this same period the expenditures amounted to $31,869,443.76. Revenues from the one-cent gas tax did not become available for expenditure until the last few months of the



ORGANIZATION CHART OF THE DIVISION OF HIGHWAYS
DEPARTMENT OF PUBLIC WORKS
1928

second year of the biennial period and consequently only a very small percentage of this money was able to be expended prior to June 30, 1928, although a considerable portion was under contract at that date. Plans are made which will maintain the expenditures as near to the revenues during the coming biennial period as is safe.

The details of revenues and expenditures for each fiscal year of this biennium are shown in the following table:

REVENUES JULY 1, 1926, TO JUNE 30, 1928

	July 1, 1926, to June 30, 1927	*July 1, 1927, to June 30, 1928*	*Total for biennium*
Bond issues			
Federal aid	$2,978,864 97	$2,434,125 74	$5,412,990 71
Contributions	170,663 91	552,702 94	723,366 85
One-cent gas tax		6,093,487 94	6,093,487 94
Two-cent gas tax	8,450,276 46	9,608,530 73	18,058,807 19
Motor vehicle license fees	3,721,414 55	3,775,453 23	7,496,867 78
Transportation license tax		249,572 93	249,572 93
Franchise tax—Stages		234,111 07	234,111 07
State general fund	69,894 52	249,965 14	319,859 66
Totals	$15,391,114 41	$23,197,949 72	$38,589,064 13

EXPENDITURES JULY 1, 1926, TO JUNE 30, 1928

	July 1, 1926, to June 30, 1927	*July 1, 1927, to June 30, 1928*	*Total for biennium*
Administration	$819,675 49	$850,542 37	$1,670,217 86
Engineering	692,505 21	878,548 63	1,571,053 84
Maintenance	5,243,078 59	4,881,187 41	10,124,266 00
Reconstruction	5,900,934 72	6,587,629 47	12,488,564 19
New construction	3,327,092 86	2,688,249 01	6,015,341 87
Totals	$15,983,286 87	$15,886,156 89	$31,869,443 76

ACCOUNTING SYSTEM

The accounting system described in the Fifth Biennial Report has been installed and is functioning. During the past biennium an important change in accounting procedure has been effected in the development of a comprehensive system of budgetary control to meet the requirements of statutes now in force. It has also been necessary to meet the requirements of chapter 794, Statutes of 1927, classifying the state highways.

The accounting system has now been in use a sufficient length of time to judge its merits and the results obtained demonstrate its value and justify its installation.

SURVEYS AND PLANS

Thorough and complete work in our preliminary engineering is being stressed with a twofold purpose in view; first that the roads and bridges will be located in the proper places and second that our plans and specifications will be competent and will not require numerous changes during construction. Highway work may be divided into three stages: preliminary study and plans, construction and maintenance. We are endeavoring by making the work in the preliminary stage complete to eliminate the necessity when the construction and maintenance stages are reached of going back and doing work which might have been foreseen in the preliminary stage.

In the planning of the designs for roads and bridges, attention is being given to future requirements, and provisions are made for future expansion and extension. The possibility of enhancing the scenic value

of highways through location and design is appreciated and is being taken advantage of where the opportunity affords. In the valley highways the designs are being prepared so that the entire width of right of way can be maintained in a neat and orderly condition by mechanical equipment and effect a material reduction in hand labor. A minimum width of right of way of 80 feet is specified by law for state highways; however, on main trunk routes, interstate connections, and similar roads a right of way of 100 feet minimum width is being secured at this time in order to provide for future development of the highways. The securing of right of way is becoming more and more expensive each year and it is anticipated that considerable future expense can be saved to the state by acquiring the wide right of way at the time the present stage of construction is being accomplished.

PROGRESS IN HIGHWAY CONSTRUCTION

Since July 1, 1926, contracts have been completed, and accepted by the state for the construction and reconstruction of the following mileages of highway classified as to type:

MILEAGE OF STATE HIGHWAY COMPLETED JULY 1, 1926 TO JUNE 30, 1928

	Prior to July 1, 1926, miles	*Placed under contract July 1, 1926 to June 30, 1928, miles*	*Total miles*
New Construction Completed			
Graded	33.1	4.8	37.9
Rock surfaced	56.0	60.7	116.7
Bituminous macadam	5.8	----	5.8
Portland cement concrete	10.7	16.7	27.4
Asphalt concrete on macadam or bituminous base	6.5	----	6.5
Total new construction	112.1	82.2	194.3
Reconstruction Completed			
Graded	6.7	41.2	47.9
Rock surfaced	46.0	33.0	79.0
Bituminous macadam surface	8.4	0.3	8.7
Portland cement concrete	42.0	51.2	93.2
Asphalt concrete on macadam or bituminous base	6.6	28.3	34.9
Asphalt concrete on Portland cement concrete	33.0	40.8	73.8
Portland cement concrete pavement widening	34.5	----	34.5
Total reconstruction	177.2	194.8	372.0
Total new construction and reconstruction	289.3	277.0	566.3

In addition to the foregoing, contracts for 71 bridges were accepted and 7 bridges were repaired.

On June 30, 1928, contracts on the following mileages of highways were in progress:

MILEAGE OF STATE HIGHWAYS UNDER CONSTRUCTION JUNE 30, 1928

	Miles
New Construction	
Grading	53.75
Rock surfacing	93.81
Oil treated surfacing	126.02
Bituminous macadam	.25
Portland cement concrete	1.79
Asphalt concrete on macadam or bituminous base	----
Subtotal	275.62

Reconstruction	
Grading	17.41
Rock surfacing	16.72
Oil treated surfacing	7.36
Bituminous macadam	7.88
Portland cement concrete	19.50
Asphalt concrete on macadam or bituminous base	2.66
Asphalt concrete on Portland cement concrete	13.56
Subtotal	85.09
Total under construction	360.71

In addition to the foregoing, 25 new bridges and grade separations were under construction and 13 bridges were being widened.

Competition among our contractors continues to be very keen. Prices continue to decline, except for grading. Average contract prices during this biennium for three major items as compared with preceding bienniums are shown below:

AVERAGE CONTRACT PRICES, JULY 1, 1921, TO JUNE 30, 1928

July 1 to June 30,	*Grading (per. cu. yd.)*	*Asphalt concrete including all materials (per ton)*	*Concrete pav'mt. including all materials (per cu. yd.)*
1921–1922	$0.71	$7.92	$14.29
1922–1923	0.74	8.10	13.18
1923–1924	0.75	7.27	13.49
1924–1925	0.59	6.43	10.85
1925–1926	0.44	5.13	10.58
1926–1927	0.50	5.68	10.74
1927–1928	0.56	4.70	10.23

PRISON ROAD CAMPS

During the first eighteen months of the biennium convict labor on state highways was limited by funds and by the desire to not enlarge the convict labor during the winter of 1927–1928, when seasonal unemployment was prevalent. During the last six months of the biennium the above conditions did not obtain and the volume of convict labor was doubled.

BRIDGES

During this biennium the bridge department was reorganized to meet the large program of bridge and grade separation work in view. A preliminary survey of all existing bridges on the state highway system was made and a rational plan of bridge reconstruction is being worked out.

The survey of the existing highway bridges discloses a large number of bridges falling into one or more of the following classes:

1. Structurally unsafe.
2. Too light for modern traffic.
3. Too narrow for modern traffic.
4. On poor alignment.

Finances do not permit the reconstruction of all of the above bridges to modern standards within a two-year period, and it is found necessary, in order to keep within the funds available, to confine the reconstruction of bridges during the next biennium to those bridges which are structurally unsafe.

A study of the grade separation situation is being made and plans are under way to carry out a substantial grade separation program.

MATERIALS AND RESEARCH

The work being handled by the Materials and Research Department has reached such a volume and is becoming so important that a separate department has been organized to handle it. In addition to the large amount of routine testing performed in connection with the construction and maintenance activities of the division, the Materials and Research Department has conducted two major investigational studies:

1. A culvert investigation to determine the best practice in the construction of drainage structures.

2. An investigation to determine the service value of fine crushed rock and gravel surfaces, and to ascertain what methods may be employed to increase the serviceability of such roads.

Information of considerable value to this state in highway construction and maintenance was secured from these investigations.

MAINTENANCE

The maintenance of the state highways continues to be an important activity. In order to furnish better service to the public on the large mileage of unpaved highways pending the time when they can be paved, the process of oiling the surfacing material has been developed and a large mileage of these highways oiled. The oiled roads on the lighter-traffic routes have proven a success and are popular with the traveling public. Maintenance costs are not materially lowered but a superior service is being furnished.

The maintenance organization is continuing the policy of making the highways more sightly and safer. Care is being exercised to cut only trees and shrubbery on the right of way where such growth interferes with the traveled roadway or drainage or where the sight distance is impaired. Trees have been planted and are being cared for along many miles of highway. The roadways are being divided into traffic lanes by painting guide lines on the pavements, and caution signs and lights are being placed where needed.

Good results are being obtained in quickly repairing storm damage with the least possible delay and hindrance to traffic. Preventive measures are being devised and executed which are steadily reducing the yearly damage from storms.

A study of the problem of encroachments on the state highways has been made and the issuance of permits for encroachments which are permitted on the highways, such as pole lines, water and gas mains, etc., has been systematized. More than eight thousand permits were issued during the past two years.

DISTRICT OFFICES AND MAINTENANCE STATIONS

No new district offices were constructed during this biennium. However, owing to the increased highway program, plans are now being prepared for a new district office and shop building at Eureka, District I, and it may be necessary to construct a new district office at San Luis Obispo, District V. A contract is let for constructing new District V shop buildings at San Luis Obispo. Twenty-one new sites for maintenance stations were secured and living quarters and storage facilities were constructed at twenty-seven maintenance stations.

HIGHWAY PROGRAM

The highway program for the biennium ending June 30, 1929, was prepared after a thorough study of the highway situation throughout the state, including an estimate of the funds which would be available for highway purposes during this period. The district engineers and the bridge engineer were instructed to submit lists of projects with estimates of cost, based at least on preliminary surveys, which they recommended for inclusion in the program, and the maintenance engineer was instructed to submit his maintenance requirements. The lists of projects submitted were reviewed by the State Highway Engineer and the headquarters staff, and the list revised to meet the funds available (after the maintenance was deducted) and the requirements of the Breed Act as well as the plan of ultimate development of the state highway system. The district engineers were then called into conference with the State Highway Engineer and the headquarters staff to review the revised lists, such further revisions being made as were deemed advisable.

When the highway program received the approval of the State Highway Engineer it was by him submitted to the Director of Public Works. Upon being submitted to the Director of Public Works the program was again carefully analyzed and such further changes were made as seemed advisable. The Director of Public Works, after he had approved the program, submitted it to the Highway Commission for their approval. After being approved by the Highway Commission the program was transmitted to the Department of Finance and the Governor for approval and submission by the Governor to the state legislature.

In order that more authoritative data might be available to guide in the preparation of future biennial highway programs toward the ultimate development of the state highway system, the State Highway Engineer, upon completion of the program for the biennium ending June 30, 1931, issued instructions to prepare a plan (including quantity estimates) for the development of the state highway system as of the year 1939. This plan will contain the estimated cost to complete the state highway system to its ultimate development as near as can be foreseen at this time. The plan, if kept up to date as construction progresses and conditions change, will serve as a guide in carrying out the development of the state highway system in a rational manner.

Concurrently with the preparation of the above plan, the work of assembling the data for the program for the biennial period ending June 30, 1933, is being commenced. The study of the projects for the 1931-1933 biennium will continue until the time for submitting the next budget arrives, and should result in a well-founded program.

ENGINEERING

Contact is being maintained with progress in highway activity throughout the country and practices in California are being maintained along strictly modern lines. The highways are being graded with wider roadbeds to provide for a minimum pavement width of 20 feet with 8-foot shoulders. The clear roadway of bridges is being made at least four feet wider than the pavement. The existing 15-foot pavements are being widened to a minimum width of 20 feet as fast

as finances permit. Where funds are not at this time available to widen these narrow pavements, crushed-rock shoulders are being constructed as a temporary relief. In the portions of the state subject to heavy rainfall and in irrigated areas more adequate drainage facilities are being provided. Good alignment and grades and proper location are being stressed; pavements are being strengthened and macadam surfacing and rock bases thickened to take care of the heavier loads which are now using the highways. More attention is being given to the general appearance of the highways, and in the location of highways advantage is being taken of the scenic possibilties of the state.

Revenues from the one-cent gas tax were not available in time during this biennium to enable much progress to be made in new construction, but it is anticipated that a substantial progress will be made in new construction during the biennium, both in grading and in paving, as well as in grade-crossing elimination.

Brief reports of the activities of each of the several departments of the Division of Highways are attached to this report.

Respectfully,

C. H. PURCELL,
State Highway Engineer
and Chief of Division.



State Highway at the Ben Ali Subway under the Southern Pacific Railway in Sacramento County.

MATERIALS AND RESEARCH

T. E. STANTON, Materials and Research Engineer
F. T. MADDOCKS, Testing Engineer (*Physical*)
G. H. P. LICHTHARDT, Testing Engineer (*Chemical*)

California takes pride in being in the front rank with respect to all matters dealing with highway design, construction, and maintenance.

Such a position can only be maintained by either constantly studying improved methods developed by other states or, what is even more important, through research and original investigational work, thus contributing to the general advance in the science of road building.

The state possesses a well-equipped laboratory and, as the Director of Public Works and the State Highway Engineer realize fully the value of thorough laboratory control of construction materials through the testing department and the necessity of developing improved methods of construction under the leadership of the research department, there is no difficulty in securing adequate financial support for any meritorius investigation.

SPECIFIC ENGINEERING INVESTIGATIONS.

During the past two years the Research Department has conducted two major investigational studies:

1. Culvert investigation.
2. Light asphaltic oil road surfaces.

Culvert investigation. A desire to determine, if possible, the relative values of concrete and the different kinds of metal commonly used in culvert construction in California and also to secure useful information regarding the proper installation and protection of the various types of culverts in service, led to a comprehensive survey of over 5000 concrete and metal culverts.

The survey was started in the summer of 1925 by Mr. C. L. McKesson, at that time Materials and Research Engineer, and was completed in 1927.

The following types and classes were inspected:

4,279	Corrugated metal culverts.
785	Reinforced concrete (monolithic) culverts up to 10′ span.
197	Concrete pipe culverts.
14	Vitrified pipe culverts.
5,275	Total.

Of these structures 4794 were on the state highway system and 481 on county roads.

Groups of culverts were selected for inspection in all parts of the state in order that the widest range in soils and climatic conditions might be included.

When properly installed and maintained, the corrugated metal type of culvert was found to be economical in most sections of the state.

As state highway work was not started in California until 1912, the average age of the corrugated culverts investigated was too short to afford information of definite value concerning the relative merits of



State Highway along Donner Lake in Nevada County.



State Highway between San Luis Obispo and Pismo in San Luis Obispo County.

the different brands of such culverts which have been installed. Before any definite pronouncement on this phase of the subject can be made with assurance of accuracy several periodic examinations at intervals of about five years should be made.

Thorough study was made, however, of all cases where excessive deterioration has occurred and, as a result of this study, certain basic rules governing the proper construction and maintenance of such culverts have been determined upon.

Mr. McKesson lists the following things to be avoided if metal culverts are to give economical service:

1. A continuously wet culvert where water is stagnant and vegetation is likely to produce organic acids in water.
2. Lack of fall or other obstruction which results in depositing leaves or organic material in the culvert.
3. Heavy vegetation in and around the culvert inlet, particularly oak trees.
4. Excessive velocity of flow, particularly where rainfall is heavy.
5. Mine water.
6. Run-off from barnyards.
7. Service or water pipes through the culvert. Usually very destructive, due to impairment of flow through the culvert.

The entire absence of structural failures in 4250 corrugated metal culverts inspected in California shows that these culverts have sufficient strength to meet highway loading requirements, and that present practices as to gauge, riveting, etc., are adequate.

Deterioration in corrugated metal culverts is due almost exclusively to corrosion, is preventable in many cases and may be greatly reduced in others.

Spelter alone does not provide sufficient protection against corrosion, except under more favorable conditions of exposure, and bituminous and other protective coatings are usually desirable even where spelter is used.

The life of metal culverts can be most economically prolonged by carefully eliminating detrimental conditions of exposure.

The probable effect of such variables of exposure as rainfall and the presence of salts, alkalis or minerals can be foretold in a general way and the knowledge can be utilized in the economic selection of culvert types.

Light asphaltic oil road surface investigation. In cooperation with the United States Bureau of Public Roads an investigation was started in 1926 to determine the service value of fine crushed rock and gravel surfaces which have been extensively constructed in the western states in recent years and to ascertain what methods may be employed to increase the serviceability of such roads.

The investigation was conducted jointly by the regional office of the Bureau of Public Roads and this department. Mr. C. L. McKesson and Mr. B. A. Anderton, chemist of the bureau, cooperated in the field studies and the analysis of the data thus obtained was made by Mr. McKesson with the advice and assistance of W. N. Frickstad, Highway Engineer of the Bureau of Public Roads.

A report of the investigation was published in 1927 by the California Department of Public Works, Division of Highways, as "A Progress Report of a Cooperative Investigation of Intermediate Road Types."



State Highway construction through thickly timbered country in Humboldt County, north of Orick.



State Highway construction in Del Norte County, along the ocean south of Richardson Creek.

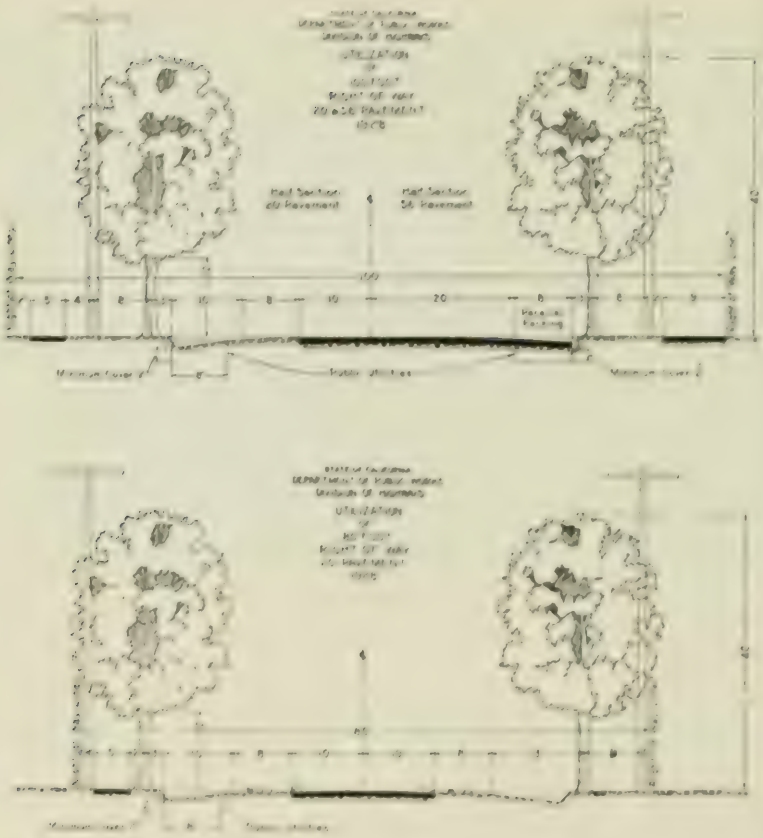
Projects are assuming greater and more varied aspects than ever before in the history of our state. With a large state highway system in varying stages of improvement, faced with necessity of constructing or reconstructing on more permanent standards and types because we more clearly recognize future highway needs, and involved in a relation to federal, county and civic road and street growth, location studies must be carried to exhaustive length.

In addition to the usual administrative and routine work, a number of research studies have been undertaken regarding highway transportation factors directly affecting location. Although many highway organizations have developed research departments they usually work in relation to construction. Location, the initial fundamental step in highway design, has received insufficient attention in research. Inconsistencies and uncertainties in economic theories of location furnish proof that it should be more thoroughly studied and understood, and progressive organizations must actively engage in that research work. Factor values on location have not been put on a working basis.

The Department of Surveys and Plans is devoting considerable attention to anticipating future requirements intelligently by assimilating theories and practices of other recognized authorities and by original studies, such as: the design of typical roadway sections adapted to efficient future expansion and extension; the effect of distance, grades, and altitude on automobile operating costs, traffic development and control; methods of application of superelevation and transition spirals to highway curves, and other economic theories with their application to highway location problems. Varied systems and mechanical devices to increase the efficiency of surveys and plan work have been adapted and their development encouraged.

Standard sections for progressive improvement of roadway and utilization of right of way were recently developed considering width of roadbed necessary to serve traffic, local conditions, public utility demands and aesthetic treatment. Improvement of adjoining property, keeping pace with the traffic demand for width of roadway, adds to congestion on the highway and brings up the question of where to strike the proper balance of the contribution that the state and the property should bear when this state of congestion and development is reached. Conclusions may support a policy which places as a limit for state construction the four lane road and, that when capacity is required beyond this standard, consideration should be given either to parallel roads or to service lanes built at the expense of abutting property.

Varied conditions do not permit universal application of a single standard. We have reconstruction and widening where considerable tree planting, curbs, walks, poles, etc., are already in place, where trunk lines are adjacent and parallel to main railroad lines and do not permit widening equally on both sides, and where main and secondary roads are in mountainous country differing in development of abutting property from that in and around larger centers of population. A flexible width of right of way with the present minimum width of 80 feet will satisfy requirements and does not prevent acquiring greater widths where that is a good investment. That a 56-foot pavement section can be readily developed on a 100-foot right of way is illustrated herewith.



Special cases necessitate individual treatment. It is readily applied in mountainous country to conform to existing conditions. Along railways a standard can be adopted for the majority of cases by the suggested design of stage development beginning with the first twenty foot pavement section with a one way crown the subsequent widening being made all on one side of this first twenty-foot section.

In general the valley trunk lines may well be handled on standard sections but departure may often be necessary. Legislation requiring set-back lines would be valuable especially at intersections and would permit further development of the 100-foot right of way by service lanes separated from the main roadway.

The opportunity and possibility of enhancing the scenic value of highways through location and design has been appreciated. By routing, location, design of pleasing horizontal and vertical curves and proper roadway and right of way sections, the location design can materially assist in improving the aesthetic character of the highway, and further the development of the same in construction and maintenance.

The small increase in the per cent of cost of preliminary engineering is consistent with the work performed and can be traced to the following causes:

(1) A greater number of projects surveyed and designed in advance for accurate data for the succeeding biennium budget.

(2) The increased cost of gathering and calculating right of way ties and descriptions, an item becoming more complex in relocation and reconstruction work on advanced standards.

(3) The inclusion of central office drafting department charges against surveys and plans in preparation of contract layouts and specifications.

(4) The inclusion of all bridge department field investigations and office design.

(5) Cooperative investigation with units other than the state in the interest of standardization and coordination of road system.

(6) Greater care and refinement in all steps relating to surveys and plans which are reflected in immeasurable practical savings and in economy in construction cost.

A simplified but remixed form for rendering monthly progress data and cost of surveys and plans has recently been put into effect. The final monthly reports on each job showing distribution of costs, uniformly interpreted throughout the state, will give an index of personnel productive and will lead to general efficiency through cooperation and interchange of ideas. The departmental review of reconnaissance survey, working plans, and finally of the completed plans is productive of a consistent quality incorporating the most progressive ideas developed throughout the organization. Final layout reviews are being made at the rate of about 120 per year.



State Highway near summit of Donner Grade in Nevada County

The standards set in survey and plans in California will not suffer by comparison with the best practices elsewhere. Considering density of population and of traffic volumes, mileages, vehicle registration, revenues, and the varied climate and topography it will be found that permanency of routing, standards of alignment, grade, width, and type are consistent with future probable demands.

That surveys and plans are concerned with a wide variety of problems is illustrated by reference to some of the projects of unusual size and characteristics now under construction: boulevards through areas of dense population, modern highways through rugged mountains and along a rough coast line, and speedways across long reaches of desert.

The Bay Shore Highway from San Francisco to San Jose, Route 68, is laid out on a standard having a minimum width of 40 feet for pavement, 60 feet for grading and 125 for right of way. Heavy grading as well as difficult right of way problems are encountered. A recent contract on this highway 3.5 miles in length includes 805,000 cubic yards of grading. The total allotment for this contract is approximately $840,000.

Improvement of the main highways around Los Angeles must provide exceptional widths of roadway to accommodate the large volume of traffic, with new, wide rights of way through highly developed territory. The Foothill boulevard, Route 9, is an instance of this kind. A 56-foot width of roadbed providing four traffic lanes with two 8-foot parking lanes is being constructed in cooperation with the abutting property.

On the Bear Valley Project, Route 43, in the San Bernardino Mountains, a recreational highway on the State Secondary System, a 5.7 mile section is being graded to 20-foot standard roadbed width at a cost of $761,000. This construction is in cooperation with the Bureau of Public Roads.



State Highway in San Bernardino County.

The Coast Highway, Route 56, between Carmel and San Simeon is being located and built along the cliffs and steep slopes above the ocean through country that will require immense cuts and fills, tunnel and bridge work to suitably feature the spectacular scenic values of this highway and develop the recreational areas.

The Coast Highway from Oxnard to Serra, Route 60, is likewise a very careful study in location to establish the best possibilities for the heavy traffic using it and at the same time preserve and develop the scenic and recreational features.

Across the southern deserts, where traffic maintains high rates of speed, permanent locations for improved surfacing and drainage conditions over long stretches is not the easy work which the simple topography and light character of grading may indicate at first sight. Detailed study is required to properly develop the extended system of dykes and ditches to protect the highway from destructive cloudbursts.

Incorporated in the tabulation of classified expenditures of the Division of Highways will be found preliminary engineering expenditures relative to the work of surveys and plans. In these expenditures are included the costs of our advance studies and investigations necessary to eliminate errors in stage construction of a comprehensive highway system in the state.

LOCATION STUDIES

A short review of some of the main advanced studies during this biennium is given.

Main line state highways. San Rafael to Sausalito—a relocation of the terminal section of the Redwood Highway providing a direct highway between above termini to avoid the congestion and hazards characterizing the present route, and reducing main route distance 4 miles.

Weldon Canyon cut-off from Santa Clara River to the city limits of Los Angeles, breaking the bottle neck existing at the Newhall tunnel on a very much congested highway and adding a necessary alternate entrance to Los Angeles with 1.2 miles saving in distance for a large volume of traffic.

San Juan Grade relocation between San Juan and Salinas on the Coast Route, offering a striking improvement of one of the few remaining severe conditions on this route which require radical treatment.

Other important problems on the coast road, State Route 2, studied in advance are: In the vicinity of San Jose and Santa Clara for realignment and avoiding congested areas. From San Ardo to Nacimiento on the Salinas River, involving reconstruction of long bridges or relocation of highway between them. Atascadero to Santa Marguerita, in the vicinity of Orcutt and in the vicinity of Arroyo Grande; three cut-offs to avoid sharp angles through small towns and otherwise improve general standard of grade and alignment.

Sacramento to Bakersfield in the Sacramento and San Joaquin Valleys on Route 4. Problems arise at all the large towns, as Stockton, Modesto, Merced, Fresno and Bakersfield, looking forward to better entrances to and passage through the cities. Grade separations enter largely into the study of the valley highway, making it an intricate study of economics of traffic service, construction and rights of way costs, roadway sections, and parallel roads adjacent to railways.



State Highway south of Bishop in Inyo County.



State Highway east of Saugus near Mint Canyon in Los Angeles County.

The Redwood Highway, State Route 1, from the Oregon state line to San Francisco. There are many lengthy relocation and revision problems on this scenic recreational, as well as commercial, road. Future maintenance difficulties in a region of known instability in formation affect location.

The Sacramento-Oakland routing presents many possibilities for future determination, unfolded in a recent study. The values of radical relocation on a direct fast highway eliminating distance and congestion on the present road must be kept in mind while making stage improvements. South of Carquinez Straits from Rodeo to Oakland city limits and north of the straits through American Canyon there are two radical relocations of unquestioned value. From Fairfield to Sacramento much distance and time can be saved when auxiliary highways are demanded.

Similar to the above in establishing a direct through routing is a line from Sacramento north to Marysville, whereon future probable demand will justify the additional road to reduce distance 12 miles.

Other state highways. The Kings River Highway from General Grant National Park to the spectacular Kings River Canyon took a great deal of advance study to determine the proper location. The road will be located through very rough, and wonderfully scenic country. It was conceived and created a state highway when standards and estimates of cost were far lower than are demanded at present.

The Feather River Route from Oroville to Quincy developed a study through lengthy branches of the Feather River. It involved very careful consideration of cost, service and legislation before the final decision was reached.

The Arrowhead Trail and National Old Trails Highways across the Mojave Desert from San Bernardino easterly to the state line received federal and state reconnaissance across harsh desert reaches.

County projects. The law granting the California Highway Commission permission to assist counties in surveys of highways not on the state system has made it possible for the state and counties to mutually gain in establishing coordinated systems of roads. The following are the most important ones reported upon by Surveys and Plans Department in the current biennium:

Vacaville to Dunnigan, Solano and Yolo counties, a short-cut through Winters between two points on State Route 7.

Stockton to Oakland, in San Joaquin, Contra Costa and Alameda counties, via Marsh Creek Canyon is a route that can be made 11 or 12 miles shorter than State Route 5 through Tracy, Livermore and Dublin Canyon. If improved on, the suggested relocations would become a very important traffic artery.

Hollister to Paicines and southerly in San Benito County follows a route capable of future extension to relieve the State Coast Route. For the present it will be the approach road to the Pinnacle National Monument and give local service.

The Susanville-Bieber routing is being studied for a preliminary survey by the state. It is a connecting link between the state laterals Redding to Alturas and Red Bluff to Susanville, and forms a southerly extension of the National Forest Highway from the Oregon state line south to Bieber.



State Highway along Lake Tahoe in Placer County.



State Highway at Slippery Ford Grade, in El Dorado County. A cooperative Forest Highway Project being constructed by the United States Bureau of Public Roads.

Relocation survey by the state of the county artery from Bakersfield to Mojave via Tehachapi is a forerunner of improvement of a route over 40 miles of mountain barrier between the San Joaquin Valley and southern California, second to the State Ridge Route in importance and volume of traffic.

Reconnaissance of a minor mountain route from Laytonville, Mendocino County, on State Route 1, toward the Sacramento Valley via Covelo was made at local request.

JOINT HIGHWAY DISTRICTS

Financing important inter-county projects, the state contributing, by formation of joint highway districts is finding increasing favor as a method of producing mutual advantages to the interested parties, and is conducive of permanent and advanced location standards. These projects usually involve long distances and a large outlay for construction.

The route from Maricopa in the San Joaquin Valley to Ventura and Santa Barbara on the Coast Highway traverses a mountainous region. It has been, and still is, subject to much study in location as it will become, by legislative act, a state highway when completed by Joint Highway District No. 6.

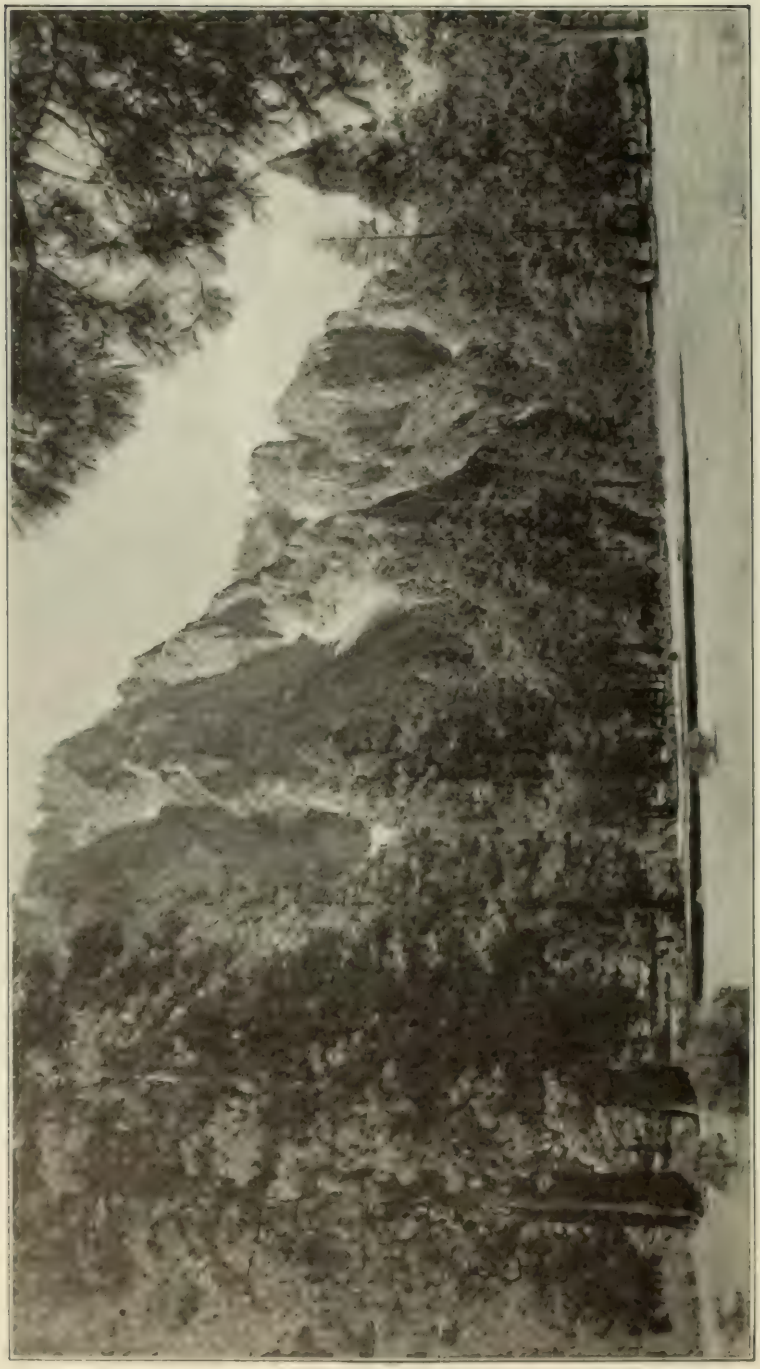
Under Joint Highway District proceedings the Woodland to Yuba City road via the Sutter causeway is to be improved. The state was vitally concerned in the preliminary studies of this route connecting the East and West Side highways by crossing the overflow area of the Sacramento Valley.

From Weed, California, toward Klamath Falls, Oregon, a new route has been studied and a joint highway district has been formed that includes some counties through which the improvement does not pass. The road is over the Siskiyou Mountains, affording direct communication from California points to a productive territory in southeastern Oregon.

FOREST HIGHWAY PROJECTS

In addition to cooperative investigations on national forest highway projects that were consummated, such projects as the Scott Mountain, San Juan-Elsinore, Modoc Lava Beds, and the Laguna Mountain routes, proposed for inclusion in the national forest highway system, have received tentative study.

These advance studies, in fact, the entire work of surveys and plans in the furtherance of the expressed policy: that the engineer anticipate the future use of highways, plan the present expenditures as permanent investments, and work toward the realization of a complete and comprehensive system of highways serving the state at large.



North wall of Kings River Canyon at Zumwalt Meadow, in Fresno County.

CONSTRUCTION

C. S. Pope, Construction Engineer

ORGANIZATION

A glance at the organization chart for 1928 indicates a separation of the testing and research laboratory from the Construction Department, as was predicted in the biennial report of 1926. There has, however, been added the general supervision of the prison camp work and a more direct and closer contact with the Department of Surveys and Plans. The large amount of statistical work which must be done and the special studies and investigations which are necessary from time to time have made it desirable to add to the personnel of the department.

MANUAL OF INSTRUCTIONS AND REPORT FORMS

During the biennium the Manual of Instructions has been revised and approved and numerous report forms have been either simplified or improved. It is the constant endeavor to secure as full information as possible on report forms, but every effort is made to cut down the paper work in the field to the lowest limit with which it is possible to properly control the work.

ENGINEERING EXAMINATION

Engineering examination and material surveys are carried on as in the past with the exception that even more attention is given to exploration for suitable materials and working out as fully as possible many of the factors which were heretofore left to the contractor to work out himself.

CONSTRUCTION POLICY

Specifications are modeled on modern highway practice prevailing in the United States and it has been the policy to consult with contracting organizations, material-men and equipment-men in order to secure a specification which is entirely practical. It is recognized that it is extremely difficult to plan for every condition which might arise and clauses have been introduced which are fair to all concerned and allow adjustments under proper safeguards. One of such instances is a clause under which the state undertakes to pay the cost of moving a contractor from one location to another in case a quarry site proves inadequate for a proper supply of material. Numerous other changes of a similar character have been embodied in our specifications.

CONSTRUCTION PRACTICE

Clearing. The magnitude of clearing operations on state highway work in California can hardly be appreciated in states where timber is less dense or smaller sized. Ordinary clearing can readily be figured at about $200 per acre whereas on several contracts in Del Norte County and one in the Redwoods, the contractor was not able to clear for less than $1,200 per acre. On one contract about eight miles in length, some 1600 trees ranging in size from 12 inches to 12 feet had to be cleared in addition to a very large amount of brush and smaller trees.

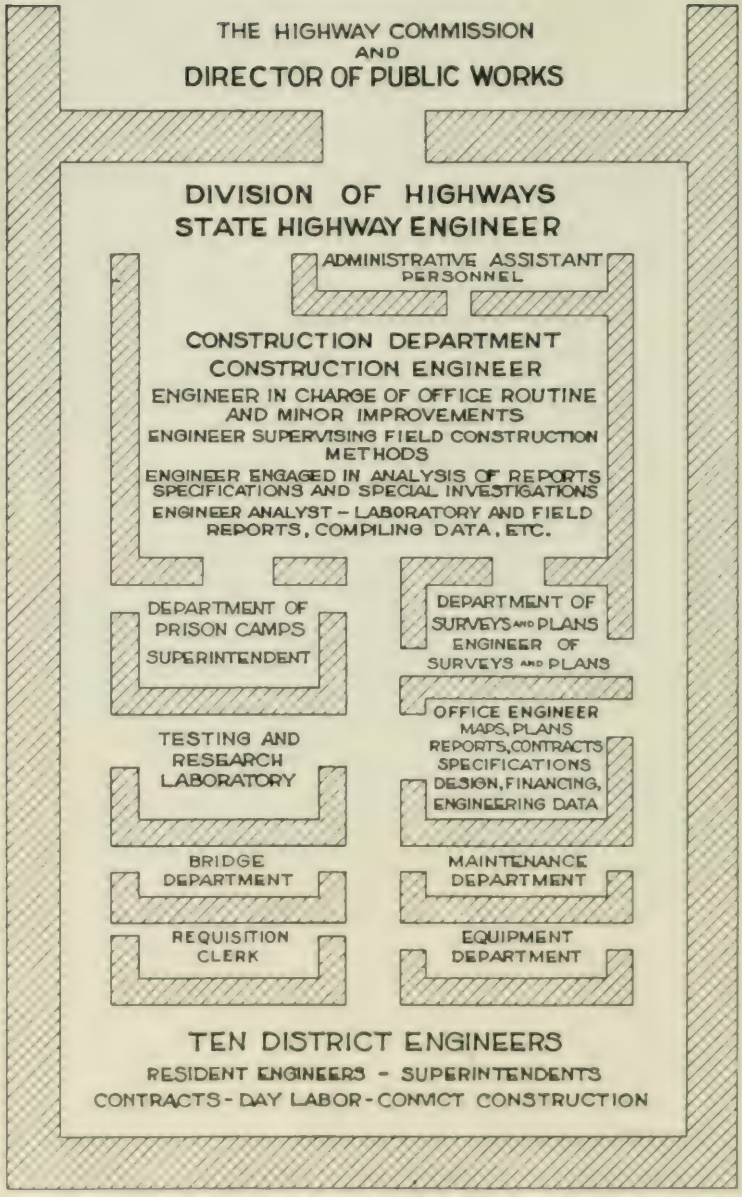


CHART SHOWING RELATIVE CONTACTS OF THE CONSTRUCTION DEPARTMENT IN THE DIVISION OF HIGHWAYS, 1928

Grading. In heavy grading it is the policy to use extreme care in the proper fixing of slopes in cuts. Where it is possible to do so, fills are brought up in a sound manner from the very first. Experience has shown that fills made by end dumping without rolling continue to settle over a period of years and that the cost of compacting embankments during construction is justified rather than to impose the added expense of maintaining them to proper grade during the time they are settling under traffic. The difficulties of making rolled fills even in rough mountainous country have been surmounted with very much less expense than had hitherto been thought possible. The practice of end dumping of trucks has been practically discontinued and the state is agreeable to building construction roads where necessary to secure fills of proper density.

Grading work runs into very large figures at times. Many miles of highway approach 100,000 yards of excavation per mile and some proposed work promises to double these quantities.

Slides. In many sections of the state it is extremely difficult to build stable highways because of slides which occur either from above or through slipping out of the road below. Numerous single slides have aggregated more than 100,000 cubic yards and in some cases no cure has seemed possible except removal of the material. It has been possible by cutting deep "V" trenches in the slides to provide a means by which the material will automatically remove itself, since these slides are wet. In other cases, permanent installation has been made with hydraulic equipment, through which the slide is sluiced out and carried away under temporary bridges as it shows movement. The use of the hydraulic method for removing soft earth has been rather extensive along the coast, where conditions are suitable.

Drainage operations in slides have been undertaken to a limited extent, but owing to the very large yardages involved they have not met with great success except the "V"-cut type of drainage. In the wet country along the north coast, the numerous fills are being, for the first time, provided with drain pipes for the removal of water which may become trapped in the body of the fill. It is usual to run a drainage system in solid ground along the upstream toe of the fill and to lead the water out of the fill at various heights to prevent slump during the heavy rainfall which occurs in this section.

Drainage structures. Culverts of reinforced concrete, concrete pipe and corrugated metal are used by the state. In order to attempt to set at rest the many different opinions as to the value of certain metals in corrugated metal pipe construction, the state undertook and has brought to a stage of completion an investigation of practically all the culverts constructed under state highways, and is now planning its work in accordance with the findings of the culvert investigation.

Headwalls, in general, are constructed only in the metropolitan districts and in such locations as they are absolutely essential.

Reinforced concrete culverts are constructed in short sections to avoid fractures which might come from beam action, and are often provided with step-down ends for the purpose of future elongation.

Cattle passes are quite universally built of redwood, as it is thought that their use is more or less transitory.

Protection against the elements. Protection against cloudbursts is necessary in many localities in southern California, and this has been attained in one particular locality by the construction of an extensive ditch and dyke system a number of miles in length, lying between the highway and the drainage slopes from which floods may be expected. The drainage cones are rather flat in grade, although some of them are many miles in extent, and the working out of a steeper grade on these cones is sometimes a matter of considerable difficulty, but has so far been handled with success.

Stream protection. In many cases it has been necessary to provide various methods of stream protection alongside all state highways where streams are of torrential character. A great number of different methods have been successfully used, including pile jetties, riprap flexible gravel and wire blankets, the use of deflecting tripods of reinforced concrete and steel, rock and brush fences set in steel frames and concrete slope paving.

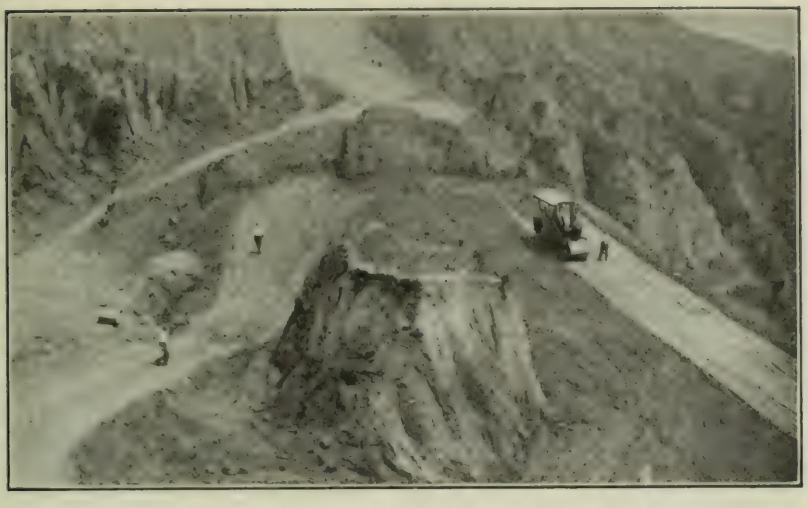
Shore protection. In a number of localities it has been necessary to construct extensive seawalls of concrete or stone, and in one location the use of heavy slope paving is being tried under extremely difficult conditions of installation.

Typical roadway sections. The standard width of grade at the present time is 36 feet, which includes a 20-foot paved section with 8-foot shoulders for parking. The slope of the shoulders has been placed at a light grade of approximately one-quarter inch per foot.

Oil surface—California type. There has been a considerable vogue in the use of a mixture of fine crushed rock and fuel oils containing 60 per cent to 70 per cent of asphalt for road surfacing in this and other states during the past two years. Numerous writers have expressed their opinions of the advantages of this type of construction and have written at length on the methods used in construction. Few have looked forward to the ultimate development of roads of this type.



Starting construction of heavy fill near Arroyo Sequit in Los Angeles County.



Compacting fill during progress of construction near Arroyo Sequit.

It is felt by this department that these roads are by no means permanent and that, at best, they merely tide over a period when funds are inadequate to cover the great distances which must be covered quickly, and that this is the only real excuse for the construction of roads of so low a type. The fuel oil makes a weak binder and one which will not withstand the action of water, and this feature renders it extremely unsuitable to localities where rainfall is moderately severe. To take the ground that these roads can be maintained and worked indefinitely does not appear to be a tenable one in view of past experience throughout California with roads of this type over the past twenty years. It seems inevitable that these roads must be considered only as a base on which there will subsequently be constructed a permanent pavement of a type adequate to withstand the burdens imposed by modern traffic.

At the present time we find that while the loss of metal which occurred in the unoiled roads has been overcome by the use of oil, the general maintenance, aside from restoration of road metal, has not been reduced.

The standard methods in use at the present time are as follows:

(a) The construction of an oil mix surface three or four inches in thickness either by mixing on the road or by furnishing material mixed in an ordinary pug mill plant at a central location. This type of surface is necessary where the cementing value of the road metal is low.

(b) Construction of a firmly bound base of road metal on which is placed an armor coat of crushed rock approximately three-quarters inch in thickness, bound with heavy road oil. It is sometimes found desirable to oil the base with an impregnation of fuel oil before applying the armor top. The latter type of road has been used where the rainfall is considerable.

(c) A combination of (a) and (b) in some localities whereby an armor top is placed on an oiled mix road.

An attempt has been made to use the first method with heavy oil containing up to 95 per cent asphalt. It has been necessary to use road oils which have been emulsified and the resulting surface consists



Reconstructing State Highway between La Moine and Castella in Shasta County.



Constructing oil treated detour along side of resurfacing contract in Marin County.



Oil treated surfacing road mix, along the Smith River in Del Norte County.

of a rough plant or road mix similar to asphaltic concrete, but which fails to have the qualities of grading or care in construction which are required of the asphaltic concrete type. So far, there has not been a sufficient amount of this type of road built to judge of its value.

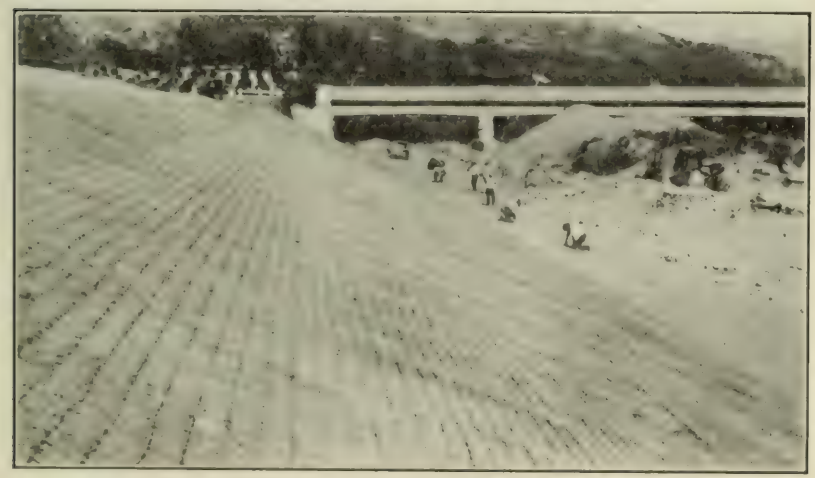
The California type of oil surfacing is usually constructed 20 feet wide in two courses. The base course is three or four inches compacted road metal and the mixed oil surface is three or four inches of a mixture of fuel oil and crushed stone. In certain locations the armor type of surfacing is used, in which the entire body of the pavement is made about five inches thick, compacted and then given an armor coat of bituminous macadam approximately one inch in thickness.

Bituminous macadam. But little bituminous macadam has been built during the biennium, and this has been of the general type heretofore used in California.

Asphalt concrete. Probably the greatest advance in this type of pavement in many years has been the introduction of the machine finish which is now used on state highways. The mixtures all carry a high dust content and a low asphalt content, and the use of the machines has given a smoothness of finish which is little inferior to the best Portland cement concrete pavement and forms a pavement which is nonskid for a considerable period of time. The method of using these machines and the results obtained have been described in various technical magazines and need not be repeated here.

Through the use of machines the output of plants has been increased to more than double their former output.

Asphalt concrete is usually constructed over the old 15-foot concrete pavement. Pavement base is usually laid adjacent to the concrete pavement, making the entire width 20 feet and an asphalt concrete surface for a minimum thickness of three to four inches is then placed. This surface is usually laid in two courses, one of which is a leveling course and the other a finishing course. In localities where the soil is



Slope protection at Big Tujunga Wash in Los Angeles County.



State Highway under construction opposite Split Rock in Del Norte County.



Bituminous macadam pavement on State Highway near Round Valley, Inyo County.

unsatisfactory, oiled rock borders four inches in depth and two feet in width are placed adjacent to the pavement.

Portland cement concrete pavement. There have been practically no changes in the handling of Portland cement concrete with the exception that all proportioning is now done by weight instead of partly by weight and partly by volume.

The standard Portland cement concrete pavement in use on state highways is 20 feet in width, six inches in thickness for a width of six feet in the center over each 10-foot traffic lane and thickening to nine inches at the edge. For heavy traffic, center thickness is made seven to eight inches and the edge thickness as much as 11 inches. Border bars are used around the edge of the slab. There have been various changes in the placing of the steel and it is now the practice to place two one-half-inch square bars in the margins of all slabs. Expansion joints with three-quarter-inch dowels are placed at 60-foot intervals and the slab divided into panels 20 feet long.

After many experiments with expansion joint material, the state is now using premoulded joints made of sponge rubber, since the plastic joints heretofore furnished have not been found satisfactory.

Reinforcement of mesh or bars is only used in special locations and is not generally standard practice.

Curing concrete pavements. Numerous tests have been made in the curing of concrete pavements by the application of impervious coats of asphaltic emulsions or paints of various kinds, but none of the results give evidence of producing concrete of as good quality as could be obtained by the use of standard methods of ponding.

Detours. For a number of years it has been the policy of the Division of Highways to construct detours over the natural soil or with the addition of a small amount of gravel and to keep such roads in more or less passable condition by extensive watering and constant maintenance. It has been found, however, that the ultimate expense on such detours is constantly growing because of the perfection of maintenance demanded by the public. During the biennium therefore, the policy has been inaugurated of constructing a substantial mixed oil and rock surfacing on detours both around sections of highway under construction and around bridges, so that for a few months they are, in effect, as satisfactory a surface as the original pavement. It is found that the expense of such detours is but little more than the cost of constructing and maintaining the old type, which was satisfactory to no one.

Pavement smoothness. There has been so much difficulty in securing comparable results by the use of the vialog that during the past year we have been working on a machine which will obtain the roughness of the pavement regardless of the vehicle to which it is attached so long as the speed of travel is maintained at a uniform rate. By the use of this machine it is hoped to overcome the eccentricities which have been evident in former machines which had to be overcome by repeated calibration.

Subfoundation. The practice of insulating pavements of all types from adverse soils by the use of subfoundations of gravel or other non-swelling material is now standard for this state.



Convict road camp at Salmon Creek, on the Carmel-San Simeon Road in Monterey County.



State Highway constructed by convict labor south of Salmon Creek, Monterey County.

MINOR IMPROVEMENTS

During the biennium the department has supervised in a general way the allotment and expenditure of approximately $1,700,000 budgeted for minor improvement work throughout the entire state highway system. Each district was allotted a share of these funds, ranging from $150,000 to $280,000 for the two-year period in accordance with its particular needs, and was required to adhere as closely as practicable to a prearranged program covering the work for each year. An effort was made to select only those projects costing in the neighborhood of from $5,000 to $10,000 for financing from these funds, and, when it could be done to advantage, the work has been let to contract.

PRISON ROAD CAMPS

With the conclusion of the present biennium, convict labor has been successfully employed in the construction of the state highways of California for a period of thirteen years.

The use of convicts in state road building operations was first authorized in a bill passed by the state legislature in 1915. The author of this measure was B. B. Meek, now director of the Department of Public Works, and then Butte County's representative in the assembly. In 1923 this act was amended in a measure introduced by Assemblyman Walter Schmidt of San Francisco to permit a money payment to convicts in addition and supplementary to the credits they were accorded in the Meek measure. In 1927 the act was again amended in a bill introduced by Assemblyman M. J. McDonough of Oakland by which a special appropriation of $600,000 was made to be used exclusively for the payment of convict wages. The same act provided that convicts employed on state highways should not come under the provisions of the Workmen's Compensation Act.

During the first three-quarter period of the 1926-1928 biennium, convict labor was confined to camps located in Shasta, Lake, Del Norte and Mariposa counties. The work was limited first by reason of lack of funds for construction, and second, by unwillingness to enlarge the convict labor during the winter of 1927-1928, when seasonal unemployment in California was very prevalent.

First collections under the one cent gasoline tax provided needed funds to supplement the special legislative appropriation of $600,000 for the payment of convict labor. Employment conditions became more favorable, and in response to the urgent necessity and the widespread demand for highway construction, an expansion of convict work upon state highways was ordered. Accordingly on June 30, 1928, six prison camps were in operation on the following roads: (See also table, page 58.)

Name of road	*Location of camp*	*Number of convicts*
Yosemite Lateral	Mid Pines, Mariposa County	54
Tahoe-Ukiah	Near Lower Lake, Lake County	61
Redding-Arcata	Schilling, Shasta County	136
Red Bluff-Susanville	Paynes Creek, Tehama County	57
Carmel-San Simeon	20 miles north of San Simeon, in Monterey County	121
Oroville-Quincy	Paxton, Plumas County	119

MILEAGE BY TYPES OF STATE HIGHWAYS CONSTRUCTED, JUNE 30, 1928

	Graded	Rock surfaced	Oil treated	Bituminous macadam	Portland cement concrete	Asphalt concrete on macadam or bituminous base	Asphalt concrete surfacing on P. C. C.	Total
PRIMARY ROADS—NORTH								
Constructed by the state	58	127	447	100	800	47	175	1,754
Constructed by U. S. Bureau of Public Roads		11						11
Constructed by City or County			1	60	7			68
Subtotals—north	58	138	448	160	807	47	175	1,833
PRIMARY ROADS—SOUTH								
Constructed by the state	170	77	126	33	615	50	171	1,242
Constructed by U. S. Bureau of Public Roads				47	63		8	118
Constructed by City or County								
Subtotals—south	170	77	126	80	678	50	179	1,360
Totals primary roads	228	215	574	240	1,485	97	354	3,193
SECONDARY ROADS—NORTH								
Constructed by the State	92	116	140	40	118	12		518
Constructed by U. S. Bureau of Public Roads	87							87
Constructed by City or County				20	4			24
Subtotals—north	179	116	140	60	122	12		629
SECONDARY ROADS—SOUTH								
Constructed by the State	22	53	8	23	12			118
Constructed by U. S. Bureau of Public Roads	17							17
Constructed by City or County				1	14	2		17
Subtotals—south	39	53	8	24	26	2		152
Totals secondary roads	218	169	148	84	148	14		781
Grand totals	446	384	722	324	1,633	111	354	3,974

During the past biennium 1051 prisoners have been assigned to highway camps. During the greater part of the biennium the population of the camps was at a low figure, only 279 men being in camps on July 1, 1926. This figure decreased to 230 during the winter of 1927-1928, but in March, 1928, the expansion of the convict camp work began.

During the two years a total of 772 prisoners were assigned to road work and 180 returned for cause. A total of 311 were paroled and discharged and 12 escaped, five of whom were captured. June 30, 1928, there were 548 in the camps.

The fact that there were only 12 escapes in two years out of 1051 prisoners engaged in road work and living in open camps is noteworthy, and is in itself both evidence of the manner in which the work has been conducted and its value to the prisoners.

Prisoners are paid $2.10 for each working day. Deductions from this include the costs of the prisoners maintenance; including board, camp maintenance, transportation from the prison to the camps and from the camps to the prison, guarding, medical attention, shoe and clothing repair, barbering, salaries (including clerical work on convict records in camp as well as the entire expense of the headquarters office), reward for capture of escapes, together with the expense of search, and all clothing, bedding, tobacco, and toilet articles.

Gross earnings of the prisoners for the biennium were $356,060.06. The expense of operating the camps, including all commissary sold to the prisoners was $310,415.49, leaving a balance credited to prisoners of $45,644.57. This constitutes an average daily saving of $0.269 per man.

The requirements for eligibility to road camp assignment include a voluntary application by the prisoner, perfect physical condition, a clean record in the prison, and the endorsement of the prison department head under whom he has worked. Every prisoner must serve the major portion of his sentence behind the prison walls, and even in the case of life termers, the prisoners who are sent to road camps must be eligible for an early parole.

Each prisoner, before road assignment, is given a pamphlet containing the simple rules and regulations governing his conduct in the prison camps. The prisoners have learned that wasting materials, including food, drawing commissaries that are not needed, staying in from work by feigning sickness, trading with free people, loafing on the work, or agitation in camp will result in being immediately returned to the prison. In cases of delinquency, after personal investigation a report is sent to the State Board of Prison Directors, and if the prisoner is found to be at fault, he not only loses all credits earned but in most cases forfeits his chance for a parole.

During the past year vocational work for prisoners in the state road camps has been extended. The work of the Director of Education and Religion at San Quentin, now includes the road camps. Libraries which, in most cases are branches of the county libraries, have also been established in all the camps. Much care is exercised in the selection of books sent to these road camp libraries and only the better class reading matter is allowed.

The difficult problem of properly caring for leisure time of road camp workers has also been successfully solved. Handball, baseball, radios



State Highway near Half Moon Bay, on the Skyline Boulevard in San Mateo County.



State Highway near Field in San Bernardino County.

and a weekly picture show assist in this work and established camp limits give the prisoners plenty of hiking space. The amount of money for amusements is very limited, making this phase of the work one to which considerable thought has had to be given. Funds for amusements are provided by the credit balances of escapes and the interest on the prisoners' savings account.

The matter of allotments to dependents is now being carefully supervised by a close cooperation between camp management, prison authorities and the Department of Social Welfare. The law provides that an inmate of a camp can allot up to two-thirds of his net savings. Following a request for an allotment, the person to whom the allotment is to be made must make an affidavit that he is dependent upon the prisoner or caring for dependents of said prisoner. The matter of making the allotment is for the decision of the prisoner, but in case he has dependents receiving state aid he must make an allotment in their favor. For the biennium, a total of $8,259.22 was allotted to dependents at the request of 97 prisoners.

With the expansion of the prison road camps a number of changes in operation have been made, the most outstanding of which having to do with the control of prisoners in the camps. Guarding, which is purely a prison function, has been placed under the direct supervision of the warden of San Quentin prison. All guards are appointed by him and are supervised in their work by his traveling representative. Thus the Division of Highways and its representatives have been relieved of all policing duties. Many other changes have been and are being made, to better attain the ultimate rehabilitation of the prisoners.

A change instituted during the present biennium has to do with handling the funds of paroled prisoners. All convicts discharged from the camps are immediately paid their savings, but the accounts of paroled men are withheld, with the exception of from $25 to $50. As prisoners can not be paroled until work has been secured for them, this is deemed a sufficient amount to start them on their new work as free men. The balance of their savings is sent to the prison where it is credited to the account of the prisoner and held in trust by the warden. It is under the control of state parole officer Ed. H. Whyte who may direct when and how it shall be turned over to the paroled men. The same procedure holds with the funds of convicts returned to prisons from road work.

The selection of commissary clerks for the six camps now in operation has been given considerable thought as these employees have quite an influence in regulating the habits of the prisoners. Many of the convicts are men who have fallen into crime because they did not live on what they earned. However, after spending from one to two years in a highway camp, these men both learn to work, and what is equally important, adjust their needs to their daily wage. A commissary clerk can be a great help to the men in camp by teaching the fundamental necessity of living within their means.

No better statement of the policy of the Division of Highways could be made than that contained in a letter written by B. B. Meek, Director of the Department of Public Works, to an inquiry from the board of



Oil treated rock surfacing east of Camino in El Dorado County.



State Highway near Crystal Springs in San Bernardino County

supervisors of Tehama County relative to convict work on the Red Bluff-Susanville highway. We quote Mr. Meek's letter:

"Replying to your letter of March 29th, relative to the use of convicts upon road work on the Red Bluff-Susanville lateral of the state highway system:

"The use of convict labor in road construction has been a policy in force continuously in California since 1915, when the first law instructing the California Highway Commission to proceed to use convicts on highway work was enacted. The obligation to use this labor is still imposed upon the Division of Highways. The extent to which it shall be used is determined by legislative appropriations. The amount so appropriated for the present biennium is $600,000. This money can be used for the payment of wages to convicts, and for no other purpose.

"The total highway expenditures for the biennium are estimated at $50,000,000. With the exception of the $600,000 appropriated by the legislature for the payment of wages to convicts working upon state highways, the remaining portion of the $50,000,000 will go to free labor, either in the form of wages or in the payment of material and equipment manufactured by free labor.

"It may interest you to know that but 20 cents out of each dollar goes to convicts on the so-called convict camp jobs. The remaining 80 cents is spent for superintendence, engineering and other free labor used in connection with such work; for supplies and equipment necessary thereto, and for bridges and drainage structures on these projects, which will be built by contract.

"The policy of the present administration is to give projects involving free labor priority over projects involving convict labor.

"During the winter the number of convicts employed on road work was kept at a low figure. The total number of convicts in the three small camps maintained during the winter was at its largest in December and then only 227 prisoners were so employed. The convict camp on the Red Bluff-Susanville lateral will use about 60 prisoners.

"Over a period of years the cost of road construction by convicts and by free labor is about the same. The fact, however, that the convicts are self-supporting while at work on the roads, relieves the state of the burden of supporting them in prison. The saving thus effected to taxpayers of the state on the basis of the employment of 850 men is estimated at more than $200,000 a year.

"The convict camp work has been a very important factor in the reformation of prisoners, who through the work were given the opportunity of accomplishing the change from prison to free life by gradual process. The hope that they may be assigned to road work has been a very potent factor in making for better discipline among the prisoners at San Quentin.

"The history of convict road work in California is that the prisoners have built excellent roads without menace, peril, or annoyance to the communities in which convict camps have been located. There are a number of counties now asking that convict camps be established on their roads. It is not the policy of the Division of Highways to force a convict camp upon a county unwilling to receive it. If this should be the case with your county, please advise us of your thought in this matter. You should understand, however, that if it is deemed advisable to remove the camp from your county, that the work laid out there for the convicts, of necessity, must go over until the next biennium."

Following is a tabulation of prison labor jobs which have been completed or are under construction as of June 30, 1928. This shows that a total of 356 miles of road have been completed or are now under construction, including 346 miles of grading and 10 miles of concrete pavement, at a total cost of $8,700,000, since the inauguration of convict work.

There follows also a statement showing statistical data relative to prison road camps in operation since 1923, when the present convict pay law was enacted. In addition, it shows the operating costs at the existing camps, prorated to the various items of expenditure, a typical

monthly record of prisoners showing number of men at each camp, paroles, escapes, etc., and the location of camps, with superintendent in charge of each.

PRISON ROAD CAMPS

STATISTICAL DATA - Aug. 17, 1923, to June 30, 1926.

	CAMP "E"	CAMP "11"	CAMP "12"	CAMP "14"	CAMP "15"	CAMP "16"	CLOSED CAMPS	TOTAL FOR ALL CAMPS
Total prisoner days	239,067	30,137	27,394	4,501	6,288	1,967	289,804	599,108
Gross earnings	508,417.48	63,469.22	57,443.96	9,452.10	13,204.80	4,130.70	608,193.99	1,258,302.25
Gross deductions	440,313.34	54,969.85	49,075.23	10,195.99	13,421.46	7,717.36	551,666.39	1,126,950.62
Adjustments	+18,673.09	+762.03	+68.63	+883.66	+684.34	+3,586.66	+19,852.18	+36,520.59
Net amount credited to prisoners	78,777.23	9,651.40	8,436.36	139.77	467.68		76,789.78	168,262.22
Daily average saving	.304	.320	.308	.031	.074		.265	.281
Allotment payments to dependents	36,454.92	807.94	1,907.93				13,997.62	37,168.41
Number of prisoners on payroll, June, 1926	54	61	136	57	121	119		
Gross excess earnings	444.40	72.74	62.28		30.32		1,186.26	1,796.00

PRORATED CHARGES PER PRISONER

	June, 1926 "E"	"11"	"12"	"14"	"15"	"16"	AVERAGE May	AVERAGE June
Salaries	4.76	4.17	1.95	3.18	1.88	7.27	3.58	3.87
Barber	.50	.21	.24	.14	.10	.30	.27	.25
Board	22.51	22.84	25.80	27.89	22.18	29.61	26.03	25.15
Camp maintenance	1.35	1.32	1.00		.56	.04	1.52	.71
Guarding	6.21	7.06	6.03	5.10	4.87	4.93	5.95	5.70
Medical	1.23	.03	.85	.94	.47	.42	.55	.51
Shoe & clothing repair	.75	.40	.36	.43	.52	.24	.58	.45
Escapes		.71	3.01	10.92			2.68	2.44
Total	37.42	36.74	39.25	48.30	30.58	42.81	40.57	39.18
*Comparable daily earning	.670	.546	.624	.280	.852	.442	.489	.571

(*Computed after elimination of days lost on account of weather, and of charges for commissary and transportation)

AVERAGE PRORATED CHARGES

	"E"	"11"	"12"	"14"	"15"	"16"
1925	42.22	45.79				
1927	42.79	42.31	38.39			
1926						
January	42.20	39.39	36.31			
February	39.56	33.[illegible]	35.51			
March	44.53	46.52	40.87			
April	45.34	32.[illegible]	35.[illegible]	32.27	44.81	
May	43.57	44.12	38.35	42.46	35.24	
June	37.42	36.74	39.25	48.30	30.58	42.81

TYPICAL MONTHLY RECORD OF PRISONERS

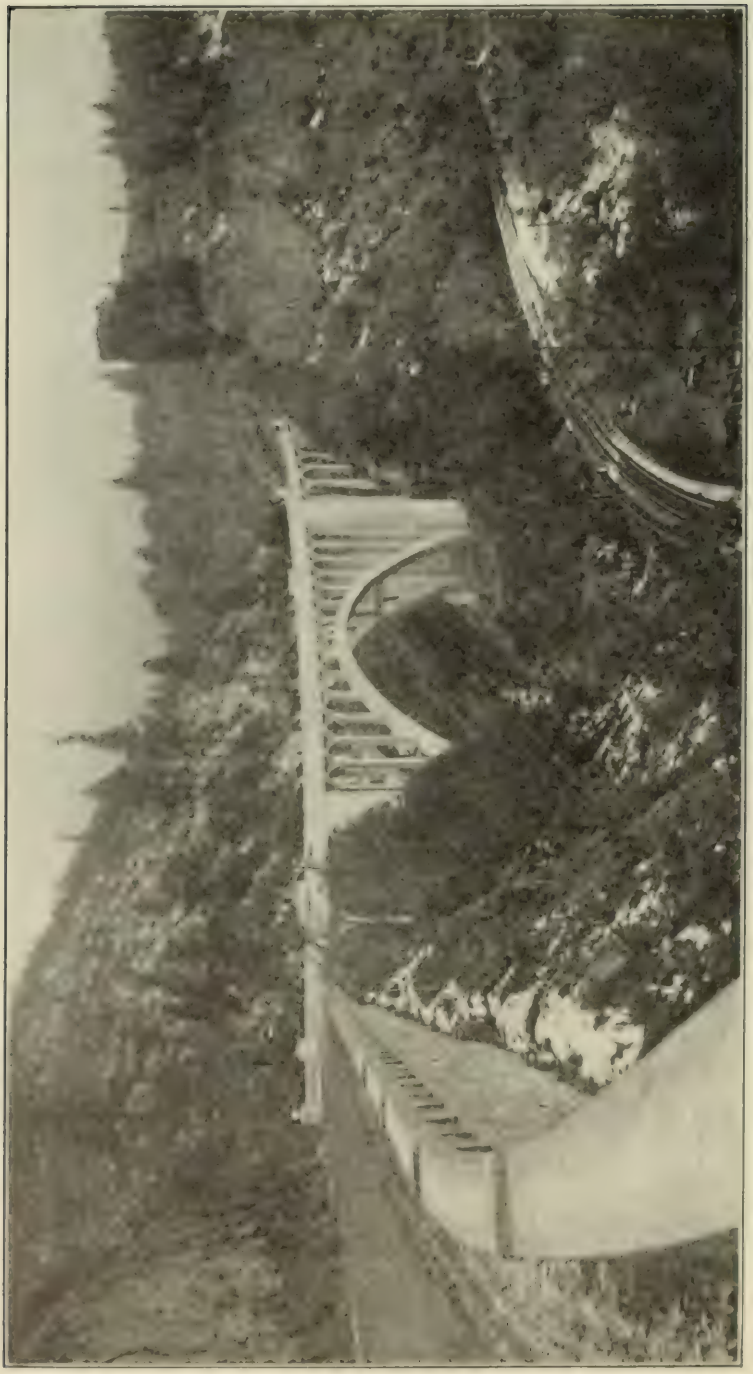
Camp No.	June, 1926 "E"	"11"	"12"	"14"	"15"	"16"	Total
Number of prisoners at camp at beginning of month	57	72	135	59	115	15	451
Number of prisoners received from prison	--	--	---	3	2	104	109
Number of prisoners attempting escape	--	--	2	3	---	---	5
Number of prisoners returned at own request or for cause	--	9	12	2	---	---	23
Number of prisoners paroled and discharged	3	2	9	--	---	---	14
Number of prisoners in camp at end of month	54	61	136	57	121	119	548

CAMP NO.	LOCATION OF CAMP	JOB NO.	SUPERINTENDENT
"E"	- Wild Pines, Mariposa County	D-550,961	W. B. Albertson
"11"	- Lower Lake, Lake County	D-521	E. D. Willis
"12"	- Schilling, Shasta County	D-575,961	B. H. Henry
"14"	- Paynes Creek, Tehama County	D-580	G. W. Lane
"15"	- In Monterey County 20 Miles North of San Simeon	D-573	H. L. Levenston
"16"	- Parton, Plumas County	D-582	A. W. Lund

PRISON LABOR CONTRACTS COMPLETED OR UNDER CONSTRUCTION, JUNE 30, 1928

CONTRACT NUMBER	DIST.	COUNTY	RTE.	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	SUPERINTENDENT	TYPE OF WORK	TOTAL EXPENDITURES
D-545	I	Del Norte	1	A	Richardson Creek	Hunter Creek	3.7	7-23-23	G. D. Grant	Grading	$ 274,423
D-582	I	" "	1	C	Crescent City	Adams Station	17.2	4-30-24	G.D.Grant,-A.N.Lund	Grading	787,036
91Y1	I	" "	1	C	Crescent City	Adams Station		8-30-27	A.N.Lund	Grading	20,761
D-345	I	Humboldt	1	I	S.19,T.7 N, R.1 E	Strawberry Creek	0.96	9- 8-20	C.H.Page	Grading	20,223
D-56	I	Mendocino	1	I,J,K	Rattlesnake Summit	Northerly Boundary	33.63	8- 1-15	B.C.Porter,A.N.Jolliff	Grading	854,929
D-195	I	"	1	H	Sherwood Junction	Rattlesnake Summit	13.76	6- 7-18	C.H.Page,G.W.Lane	Grading	211,387
D-208	I	Mendocino	1	G	Arnold	Sherwood	10.19	9-25-18	G.M.Brown	Grading	241,449
D-173	III	El Dorado	11	A	White Rock	Shingle Springs	10.28	11-28-17	W.B.Albertson	P.C.Conc. Pav't.	258,120
*D-621	III	Lake	15	B,C	Clear Lake Oaks	Abbot Mine	19.3	3-30-26	G.W.Lane,E.D.Willis	Grading	189,298
*93Y1	III	"	15	B,C	Clear Lake Oaks	Abbot Mine		11-16-27	G.W.Lane,E.D.Willis	Grading	26,580
D-550	VI	Mariposa	18	E,F,G	Briceburg	El Portal	17.0	9-20-23	W.B.Albertson	Grading	1,331,086
98Y1	VI	"	18	E,F,G	Briceburg	El Portal		8-29-27	W.B.Albertson	Grading	2,499
*98Z1	VI	"	18	D,E	Mariposa	Briceburg	13.47	7- 1-27	W.B.Albertson	Grading	122,536
*96Y2	VI	"	18	D,E	Mariposa	Briceburg		8-29-27	W.B.Albertson	Grading	35,589
D-619	VI	"	18	F	Across So.Fork,Merced Riv.			4- 1-26	W.B.Albertson	R.C bridge	34,446
D-309	I	Humboldt	20	C,D	Redwood Creek	Easterly Boundary	25.0	2-26-20	G.D.Grant	Grading	652,012
D-558	II	Shasta	20	A	Westerly Boundary	Tower House	3.6	11- 9-23	R.W.Brown	Grading	227,433
D-575	II	Trin-Sha	20	B,A	Westerly Boundary	Tower House	21.5	10- 5-27	B.H.Henry	Grading	95,177
*92Y1	II	" "	20	B,A	Westerly Boundary	Tower House		10- 4-27	B.H.Henry	Grading	43,421
D-530	II	Trinity	20	B	Tom Long Gulch	Grass Valley Creek	3.53	12-27-22	R.W.Brown	Grading	153,025
*D-681	II	"	20	B	Tom Long Gulch	Easterly Boundary	10.3	2-27-28	B.H.Henry	Grading	18,141
*92Y3	II	"	20	B	Tom Long Gulch	Easterly Boundary		2-18-28	B.H.Henry	Grading	5,817
D-354	II	"	20	D	Burnt Ranch	Whites Bar Creek	15.7)	2-25-21	R.W.Brown	Grading	577,735
"	II	"	20	F	Helena	2.6 miles east	2.6)				
*D-683	II	Butte	21	B	Feather River Crossing	7 miles north	7.0	4-25-28	Edward Rawson	Grading	21,803
*92Y5	II	"	21	B	" " "	" " "		4-25-28	Edward Rawson	Grading	-
*D-682	II	Plumas	21	B	Twain	Keddie	8.5	4-25-28	A.N.Lund	Grading	32,282
*92Y4	II	"	21	B	Twain	Keddie		4-25-28	A.N.Lund	Grading	3,506
D-104	X	Calaveras	24	B	Valley Springs	San Andreas	10.0	5-11-16	W.J.Hunter	Grading	60,856
D-175	III	Nevada	25	A	Nevada City	Northerly Boundary	18.0	12-28-17	R.W.Brown	Grading	320,984
D-116	III	Sierra	25	A	Westerly Boundary	Downieville	17.33	1-25-17	L.H.Taylor	Grading	302,136
D-154	III	Yuba	25	A	Southerly Boundary	Easterly Boundary	11.07	9-11-17	R.W.Brown	Grading	111,152
D-355	II	Shasta	28	A,B,C	2.3 Mi.S.W.of Ingot	Burney	17.72	2-25-21	H.K.Ward,F.C.McCauley	Grading	523,702
D-117	II	Lassen	29	B	Near Susanville		1.0	1-29-17	S.W.Lowden	Grading	775
*D-680	II	Tehama	29	A	Paynes Creek	7.2 miles west	7.2	2-10-28	G.W.Lane,L.H.McCandless	Grading	42,781
*92Y2	II	"	29	A	Paynes Creek	7.2 miles west		2-10-28	G.W.Lane,L.H.McCandless	Grading	8,285
D-459	II	Siskiyou	46	D	Daggett Creek	Rte. 3, Shasta River	20.7	5- 3-22	L.H.Taylor	Grading	529,204
*D-679	V	Monterey	56	A	Salmon Creek	1/2 Mi.N. of Spruce Crk.	8.0	12-22-27	H.L.Leventon	Grading	53,794
*95Y2	V	"	56	A	Salmon Creek	1/2 Mi.N. of Spruce Crk.		2-21-28	H.L.Leventon	Grading	11,667
D-581	VI	Kern	57	G	1st Xing Kern River	Democrat Springs	8.4	4-30-24	R.W.Brown	Grading	538,684
TOTALS							356.64				8,720,153

NOTE.—In addition to above, several small prison labor jobs for grading, etc. were done under maintenance funds in 1916-17.
* Contracts under construction as of June 30, 1928.



Bridge over Dog Creek on State Highway in Shasta County

BRIDGES

CHAS. E. ANDREW, Bridge Engineer

The work of the Bridge Department consists of designing bridges and grade separation structures, including the collecting of data necessary for design; the supervision of the construction of these structures; investigating and reporting on existing bridges to determine the loads which they are capable of carrying, and their adequacy in other ways to render the service for which they are intended; the making of special investigations and reports in relation to bridges; and the preparation of designs for special culverts or structures which are included in road contracts.

During the biennium ending June 30, 1928, seventy-one bridges and grade separations have been built and completed under the supervision of the Bridge Department. Seven bridges have been repainted and repaired. The total cost of this work was $2,600,000. On June 30, 1928, twenty-five new structures were under construction and thirteen were being widened, the total value of these going contracts amounting to $1,145,000.

Some of the outstanding developments during the biennium have been:

(1) The greater attention paid to the securing of site data not only to determine the proper structure for each location, but also to get in the contract all necessary work to finish the project in hand with a minimum of extra work.

(2) The investigation of existing structures and consequently having data on hand for use in the preparation of the budget.

(3) The more extensive use of timber structures and the development of suitable specifications for redwood bridge timber.

(4) The increased construction of three and four traffic lane bridges and greater attention paid to designing two and three traffic lane structures so that they can readily be widened.

(5) Making thorough preliminary studies of proposed grade separations, including the preparation of a preliminary report or brief covering each project, and then transferring to the Division of Contracts and Rights of Way the negotiations with the interested parties in regard to participation and necessary action before the Railroad Commission.

SITE PLANS AND SURVEYS

In the carrying out of a bridge contract, incorrect or insufficient site data shows up by the necessity for changes in plans and extra work. Changes, in nearly all cases, cost more than if the work had been correctly shown and included in the original plans and specifications; also by altering the original contract, there are possibilities of contractors' claims for extra compensation. The present endeavor is to include in the original contract, all necessary incidental work, such as detours, moving fences, etc., that can be forseen, in order to eliminate extra work as far as possible.

Previous to 1927, the Bridge Department depended almost entirely on the district engineers for site plans and site data. Representatives of the bridge department conferred with the district engineers and

inspected the sites in a general way, but responsibility for the correctness of the information rested with the districts. Some of the districts furnished excellent site plans and very complete data for preparing bridge plans and specifications, while the information submitted by others was very sketchy.

The increase in highway construction due to increased and assured finances has made it necessary that the Bridge Department should have its own survey parties for securing site plans in order to avoid delays incident to relying on the survey parties of the districts who are busy with increased work of their own. As the survey parties of the Bridge Department are in close touch with the designing engineer and are specializing on bridge site plans, it is expected that they can secure complete and pertinent data more quickly and economically than the average survey crew who do not know exactly what is wanted and either secure too little or waste time taking too much. More attention is also now given to securing adequate foundation data.

In order to coordinate the securing of site data with construction, the bridge construction engineers in the northern and southern sections of the state have been made responsible for securing correct site data in addition to their responsibility for supervision of construction. This information is secured by survey parties under their jurisdiction, or they check site data furnished by the district engineer to see that it is correct and complete.

Lines and grades for bridge approaches must of necessity be secured from, or worked out in conjunction with, the district engineers. The district engineers and their maintenance men are also usually familiar with high water, drift and other local conditions affecting the design of a structure, and their advice on such matters is always sought.

INVESTIGATION OF EXISTING BRIDGES

On May 11, 1927, the California Highway Commission directed that an investigation be made of all bridges on the state highway system to



Bridge over Downey Creek on State Highway in Shasta County.

determine the condition, safe load limits or other restrictions of each structure and that progress reports be made with recommendations.

A rapid field survey of all the bridges on the state highway system was made and a progress report was submitted in January, 1928. This report contained the first complete list which this office has had of all bridges on the state highways. Each structure was assigned a number and a tabulation prepared giving the location, the type of structure, length of bridge, width of roadway, etc., and each structure was classified as good, fair or dangerous, both from a structural and from a traffic standpoint. It is estimated that to completely investigate and report on the sixteen hundred bridges on the state highway system, it will take two or three years' time and cost approximately $60,000.

While the original purpose of this investigation was to determine the condition and load capacity of the bridges, it is serving an equally important use in forming the basis from which to prepare a systematic and rational program of bridge reconstruction and major repairs.

In previous years bridge projects were initiated almost entirely by the district engineers as the bridge engineer had no data on which to formulate a program. With the aid of data secured from this investigation, the bridge engineer has been able, after conferring with the district engineers, to recommend to the state highway engineer a logical bridge program for the whole state.

Budgets for bridge work and road work can not be made independent of one another. Structures necessitated by highway construction have their inception, naturally, in the plans of the road engineers. But with the information obtained from this investigation, the bridge engineer is in a much better position to give reliable advice to the district engineers relative to which structures are in immediate need of replacement, which ones need major repairs, and the probable future life of bridges in fair present condition. As pointed out in the progress report referred to above, while at first glance, $60,000 may appear rather



Approach to Sacramento River Bridge on State Highway in Sacramento County.



Redwood Creek Bridge on State Highway in Humboldt County.



Crossing over the Santa Fe Railroad near Carlsbad in San Diego County.

large to spend for the investigation of existing bridges, the information is necessary to work out a logical and economical program of reconstruction. This amount, equal to the cost of one ordinary bridge, is less than half of one per cent of the roughly estimated cost of $15,000,000 required to bring the unsuitable bridges up to proper standards of traffic requirements and bridge construction. In the carrying out of this program, the data obtained from the investigation should save its cost many times over.

TIMBER BRIDGES

There has been an increased number of redwood and creosoted Douglas fir bridges built during the past biennium. For several years, the great majority of short span bridges on the state highways have been built of concrete. They were built for permanent structures, but the large, unlooked for increase in traffic and the much higher standard of alignment now in use on the connecting highways have rendered many of these bridges, with narrow roadways and poor alignment of approaches, either dangerous or very unsatisfactory for present-day conditions.

Where the bridges are narrow, but on good alignment, the defect can be remedied by widening the structure, and this has been done in many cases; but, where the alignment of the approaches is poor, it frequently happens that this can not be corrected without abandoning the existing bridge altogether. It has thus developed that many of these so-called permanent bridges have become obsolete in less than ten or fifteen years.

Assuming a thirty-five year life for a creosoted fir or redwood timber bridge and neglecting the fire hazard, the timber bridge will in most cases be slightly cheaper in the long run than a permanent concrete structure, the saving in first cost being more than enough to rebuild the timber structure at the end of thirty-five years. The disadvantages of the timber structure are the fire hazard and the inconvenience to traffic at the time of rebuilding. When the available funds for any bridge project are limited, there is therefore no loss in economy in building a timber structure, and where there is any doubt as to the permanency of location for a crossing, a timber bridge is obviously the economical type.

California is the home of redwood, and it is fitting that the state should make use of this native product provided it can be done without sacrifice of efficiency or economy of construction. The existing commercial grading rules covering redwood were not developed primarily to cover use as bridge timbers and material satisfactory for this use was not always obtained by these rules. The requirements for bridge timbers are a dependable structural strength and a long life in exposed conditions. Tests made on redwood furnished under these commercial rules were very erratic and while there are examples of redwood bridges in good shape after fifty years of service, comparing favorably with the life of creosoted Douglas fir, there are other examples where the life of redwood was less than the life of untreated fir.

In an endeavor to secure redwood lumber best suited for bridge construction, an extensive investigation has been personally made by the bridge engineer, and, in conjunction with the California Redwood

Association and the leading redwood mills of the state, a new set of grading specifications have been written with the classifications of "dense all heart structural" and "dense select all heart structural." With the cooperation of the mills, the specifications have been made practical to the end that the specified lumber can be furnished at economical cost. It is believed that under these specifications we are assured a product of dependable strength and long life.

Permissible unit working stresses in redwood are about 25 per cent less than similar working stresses in Douglas fir. Our standard timber bridge plans have been prepared to cover designs for redwood and Douglas fir so that for any particular case the material deemed best suited may be specified or alternate bids may be asked for. This condition is developing a healthy competition not only in price but also in securing a better quality of lumber and better service in the matter of delivery.

WIDER BRIDGES

Increased traffic on the highways and the consequent need for wider roadways has made bridges with eighteen to twenty-one-foot roadways which were built only a few years ago, too narrow for present service. In many cases they are dangerous. During the biennium eighteen bridges were widened under separate bridge contracts, and the widening of many more small structures were included in road contracts.

On account of the expense and difficulty involved in widening an existing structure and the few years before widening may become desirable, as past experience has shown, it is now the policy to build a bridge for its estimated ultimate required width or else to so design the structure that it may be economically widened in the future. This policy has caused the construction of many more three and four traffic lane bridges during the past biennium than ever before. Where ultimate twenty-foot, thirty-foot, or forty-foot pavements are foreseen as probable, the bridges are made with clear roadway widths of twenty-four, thirty-four, and forty-four feet respectively. Almost no bridges are now being built on the state highway with less than twenty-four feet clear roadway.

GRADE SEPARATIONS

During the biennium eleven grade separation structures have been completed, involving an expenditure of $530,000. On June 30, 1928, two separations were under construction and plans were under way for nineteen others budgeted to be built in the fiscal year ending June 30, 1929. The program for the eighty-first and eighty-second fiscal years includes twenty-one such structures. The maximum number of grade separation structures built in any previous biennium was eight.

Of the above eleven structures, two were reconstructions of existing, inadequate subways, one was on an entirely new line, and eight eliminated grade crossings. In addition, five grade crossings were eliminated by relocation of the highway. On June 30, 1928, there remained approximately two hundred and sixty grade crossings of the state highway over main line tracks and something over one hundred grade crossings over spur or switch tracks.

The increased progress in the elimination of grade crossings is due primarily to the additional funds now available from the increased gas



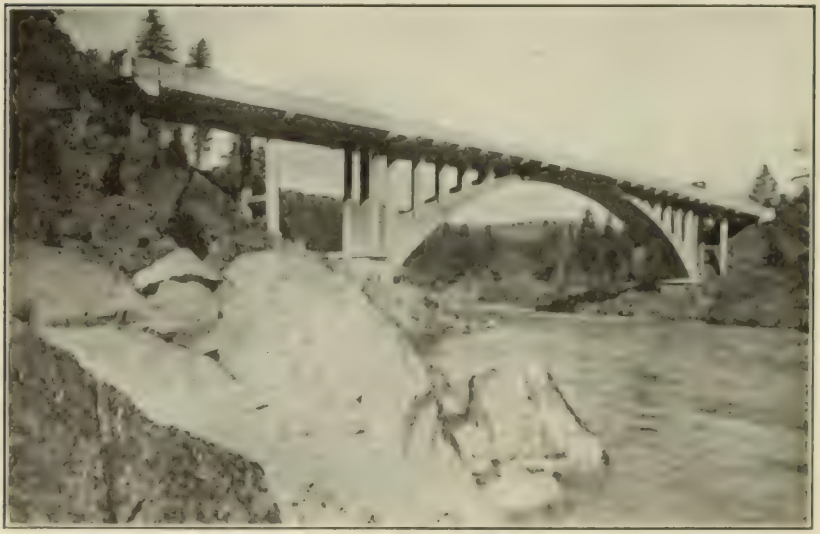
Widened roadway on bridge near Tustin in Orange County.



Junction of State Highways and railroad grade separation at Serra in Orange County.



Bridge and pavement widening on State Highway in Stanislaus County.



Bridge over Smith River on State Highway in Del Norte County.

tax. However, the slower rate of progress in the past has been due in part to delays, caused by the fact that plans and negotiations were not completed in time to contract the work when programmed. On account of the number of interested parties whose cooperation and approval is necessary in effecting a grade separation, it takes at least six months and in many cases more than a year to complete the plans and reach agreements as to the division of cost. With assured finances and a definite budget adopted, it is now possible to prepare plans and estimates and complete negotiations well in advance of the proposed period of construction.

In order that construction work may start on schedule time, this department is now notifying the railroads of the proposed program and starting the preparation of engineering briefs covering each proposed grade separation, as soon after the adoption of the budget as possible. This preliminary report contains maps and all pertinent data in regard to existing conditions at the site with preliminary plans and estimates for the proposed structure. It also gives recommendations as to the amount of participation we believe should be requested from the railroad with reasons therefor. These reports are turned over to the Division of Contracts and Rights of Way to secure the necessary agreements with the railroad in regard to participation in cost and to make the necessary application to the State Railroad Commission for an order authorizing construction.



District II Maintenance Station at Douglas City, Trinity County.



Well trimmed trees along State Highway in San Joaquin County east of Lockford.

MAINTENANCE

T. H. Dennis, Maintenance Engineer

Maintenance is that "service" which conserves the original road investment while assuring comfort and economy of operation to its users. The function of the Maintenance Department is to standardize, as far as economical, the labor, equipment, and materials involved in this service. Accordingly a general supervision is exercised over all highway maintenance including minor betterments, roadside activities, trees, encroachments, traffic census, and housing.

The "Manual of Instructions," prepared and issued in July, 1927, has aided materially in developing not only uniformity of practice, but satisfactory relations with the public for whose benefit our work is prosecuted.

ORGANIZATION

The maintenance engineer supervises the work of the organization. There is an assistant and small office force at headquarters to handle the administrative details and two field assistants who are constantly in touch with the work throughout the state. There is also an arboriculturist assigned to the supervision of the roadside trees and beautification work.

The actual performance of the work is under the direction of the ten district engineers, assisted by the district maintenance engineer who actively controls the field force.

In some districts the foreman, with sections 20 to 30 miles in length, report directly to the district maintenance engineer; however, in most of the districts a superintendent of maintenance is assigned the care of 100 or more miles of highway and has several working foremen or patrolmen under his direction.

EQUIPMENT

The adoption of auto motive equipment to maintenance activities has been remarkably rapid and effective. Where once the patrolman's equipment consisted chiefly of picks, shovels and wheelbarrows, with an occasional drag or light grader on important sections, today this equipment has been amplified by the addition of modern tractors and trucks with the various attachments adapted to each. Low-bodied, high-speed power dump trucks, of one to one and one-half-ton capacity, now convey the men to their work, making possible the assignment of some thirty to forty miles of territory to each patrol unit. In comparison between trucks of this capacity and those of a heavier type on short hauls such as usually prevail in maintenance, the differential in load is more than compensated for in the lower cost of operation, speed in transit, and ease of hand-loading the lower body.

Grading of the roadsides and traveled way is now performed by tractors, either wheel or crawler type depending largely on the tractive conditions encountered, drawing engine steer graders or operated as a unit with grader attachment.

Of the crawler type tractors, capacities of approximately two- and five-ton have to date proved most satisfactory. The comparatively



Shoulder drag on State Highway in Fresno County.



Maintenance station at Bishop in Inyo County.

recent production of an intermediate capacity, will no doubt eventually eliminate the lighter type as the added power and field of work more than offset its increased cost of operation. Under our general conditions of blade grader use, the crawler type tractor has proved more satisfactory as a motive unit rather than when unified with the grader. The use of rubber treads to reduce the abrasive action on certain types of road surface has not proved economical and it is felt the use of street plates, together with proper caution when turning, will do much to reduce this damage.

Wheel tractors, either drawing drags or with grader attached, have met and satisfactorily solved one of our big problems of surface maintenance; however, the particular surface condition prompting the use of tractor graders is gradually changing as a result of the light oil surface treatments. Where formerly a tractor grader was assigned to every ten miles of road, now the same unit is performing shoulder grading on five times that mileage. From the present trend it appears that the improvement with oil, of both surface and shoulders, will either limit the use of this equipment to unimproved sections of highway or gradually change its field from maintenance to that of construction.

The extensive use of asphalt and fuel oils for treating road surfaces during the past two years, has prompted the development of our heating equipment. Larger kettles are used, some being provided with an auxiliary compartment where an additional barrel may be rolled upon racks and heated while the asphalt in the main tank is being withdrawn, thus providing a constant supply of hot asphalt. For the heating of tank cars, steam boilers, retorts and pumps have been assembled as a unit and installed on rubber-tired trailers, making it possible to take delivery at any railroad siding and thereby shorten the haul.

The development of an auxiliary moldboard and blade in conjunction with the tractor grader, has reduced our work in shoulder grading, as this attachment blades off the surplus dirt, thrown upon the pavement during grading operations, simultaneously with the grading.

Light gasoline shovels of one-fourth to one-third cubic yard capacity have proven very satisfactory, both in minor grading and slide removal operations. Due to their mobility and light weight, it is usually possible to open up a pathway over the face of the slide, rather than effecting immediately its complete removal, thus expediting the movement of traffic.

All equipment used is rented to the various districts by the equipment department, the rents being based on upkeep and replacement. Due to frequent improvement in equipment types, obsolescence is an important facor in determining rental rates. As the equipment rentals approximate 32 per cent of the total general maintenance expenditures, our endeavor is to suitably equip each job to the end that a minimum number of pieces of equipment will receive a maximum use. This department is constantly on the lookout for either improvements in type or application of use which will effect a reduction in maintenance costs.

HOUSING AND STORAGE

In the extensive territory administered, many locations, while desirable as working centers, offer little or no accommodations for labor or storage of equipment. Quickly realizing the necessity of both, the state initiated a policy of acquiring maintenance sites, either by lease or purchase, and constructing thereon the shelters needed. To date, some 194 sites have been acquired, 61 by lease and 133 by purchase or special use permit; the total investment, exclusive of shops and office buildings, amounting to $633,700. While the investment is considerable, it usually does not exceed the rental charge for these accommodations capitalized at five per cent, and in addition assures a higher type of labor and protection for equipment.

The site, ordinarily one acre in area, is fenced and a plot reserved about the cottage which is planted to lawn, trees and shrubbery. The standard foreman's cottage, consisting of four rooms, bath and basement, cost between $3,000 and $3,500. Its rental is based on a yearly depreciation of four per cent. plus upkeep. Where the number of laborers justifies, a standard bunkhouse, consisting of living room, kitchen, sleeping quarters, toilet and shower, is constructed at a cost of approximately $2,000, no rental being charged for its use.

Standard truck sheds, ranging in size from 60 feet to 100 feet in length by 30 feet in width, are constructed of galvanized iron sheeting over a substantial wooden framework, with concrete floors, wash racks, pits, sink, toilet and lights, at a cost of $25 per lineal foot.

Maintenance stations, disbursing daily fifty gallons or more of gasoline, are equipped with a five-gallon gas pump and standard oil shed, which not only reduces hazard but effects a saving in labor and supplies as well.

It is hoped to eventually secure and improve maintenance sites at all important working centers, as the increased morale of the men, protection afforded equipment, and the accessibility of both in times of emergency amply justify the continuance of this policy.



District VIII maintenance Station at Palowalla, Riverside County.



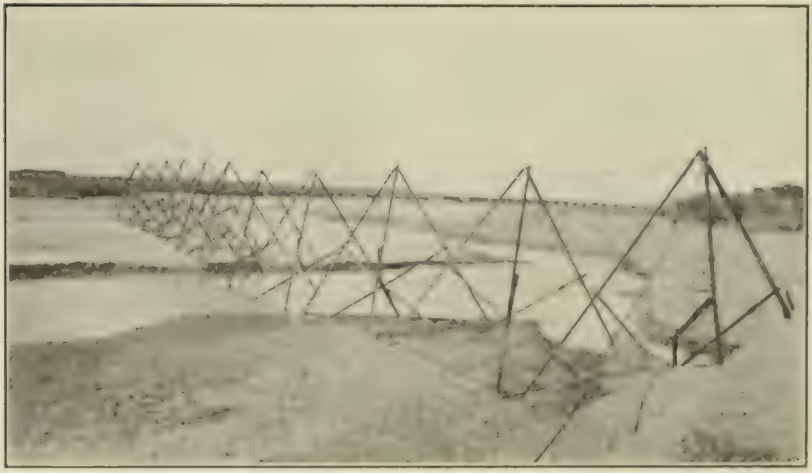
Snow removal with rotary plow on State Highway.



Snow slide in Sonora Pass, Tuolumne County, July, 1927.



Bank protection with concrete tetrahedrons, Santa Clara River in Ventura County.



Bank protection with railroad rail tetrahedrons, near San Felipe Bridge in Imperial County.

LIGHT OIL TREATMENTS

In 1926 some 60 per cent of the roads maintained were either graded earth, or crushed rock and gravel surfaced. Under fast heavy traffic the deterioration of these roads was rapid and the dust nuisance very acute. Under these conditions any reasonable method of maintenance which eliminated dust and conserved the material was clearly economical. Encouraged by the state of Oregon's success in the use of light oils under similar conditions, we began treating our crushed rock and gravel surfaces with heavy fuel oils, containing 60 to 70 per cent of 80-degree penetration asphalt. Three grades were used, being classified in accordance with their respective viscosities, as light, medium, and heavy. Light fuel oil is specified as having a viscosity range of 10 to 25 Engler at 122 degrees F., medium 25 to 45, and heavy 45 to 80 degrees.

Two methods prevail, the penetration as used in Oregon on tightly bound roads, and the mix or turnover, a development of our own, for roads loosely bound due to lack of suitable binder and where the cost of the additional oil necessary in this method is less than the importation of binder used in conjunction with the penetration. A brief description of both methods follows:

Penetration method. On crushed gravel or stone roads, tightly bound, the surface rock is exposed with a power broom. Light fuel oil heated to between 150 degrees and 200 degrees F. is applied with a pressure distributor at the rate of one-fourth gallon per square yard of surface treated, and allowed to penetrate. The period of penetration varies from six to twenty-four hours, depending on the tightness of the base. Penetrations secured vary from one-half inch to one inch. While the top is slightly sticky, a second application of one-fourth gallon per square yard of heavy fuel oil is made, the free oil not taken up by the base being screened with clean rock or pea gravel three-fourths inch to one-eighth inch in size. Experience, however, demonstrates that



Woven wire and brush bank protection work, Santa Ana River in Orange County

better results are secured by making one-half inch the maximum size of the rock. Inasmuch as this cover material is for the protection of traffic, the amount varies with the conditions encountered. Usually 100 to 120 tons per mile are sufficient, but where it is necessary to immediately carry travel over the new work, 120 to 160 tons are required.

The public appreciation of this type of surface is very emphatic, but its popularity would rapidly wane were not a stringent control exercised during the period of oiling. Travel is detoured where possible, or the road oiled in widths permitting of two-way traffic. On narrower roads with light traffic, controls are established at convenient intervals, allowing one-way travel. On similar roads with heavy traffic, each application of oil is covered with screenings. Warning signs are also placed along and some distance each side of the work, with watchmen to stop and warn traffic.

The success of the above method is predicated upon the assumption that the treatment be applied to a stable base, founded on a compact and well drained subbase. Since the oil treatment does not add strength to the surface, treatments applied on thin base, or poorly drained sections are doomed to failure. Oil treatments will not withstand concentrated iron tired traffic, nor the disintegrating effects of cleated tractors. Nearly 800 miles of this type have been constructed at an average cost of 9½ cents per square yard. This cost includes labor, equipment rentals, supplies and materials.

It has been our experience that maintenance is necessary on this type immediately following construction, as there are bound to occur spots where the surface dust has not been entirely removed and the oil does not penetrate into the base. In these places the oil peels off under traffic and patching is required at once. Two methods of patching are used: shallow, involving sweeping, painting and covering with screenings, and deep patching, where a premix of rock and oil are used, the rock being graded from coarse to fine, the oil in both cases being similar to that used in the treatment. Where the latter method is used, materials are stockpiled at convenient intervals and a small concrete mixer, mounted on rubber tires, is moved from stock pile to stock pile. Our present experience with the penetration type would indicate that, under the most favorable conditions, retreatment will be required within three years; also, that in coastal sections with heavy rainfall, the tracking of clays over these surfaces in conjunction with the rainfall and traffic is apt to emulsify the light oil. In these sections an oil of heavier asphalt content would no doubt prove desirable.

The cheapness of oil treatment has made possible the improvement of roads which under normal circumstances would have been postponed to some time in the future. The elimination of dust with its attendant discoloration of the roadside foliage, and the resultant smooth hard surface has added much to the enjoyment and appreciation of our natural scenic roads, and while there is a certain discomfort experienced during the period of its treatment, the motorists have been more than compensated by the final results.

Mixing method. This method, while necessitating more oil, presents less interference to traffic. The base is first scarified to a uniform depth of three to four inches, then harrowed. After harrowing, one-half the width of the road is covered with oil of medium or heavy viscosity, heated to between 150 degrees and 200 degrees F., and applied

with a pressure distributor at the rate of approximately one and one-half gallons per square yard of surface treated. Immediately after oiling the road is again harrowed to prevent the oil picking up on the equipment doing the mixing. Power graders, or tractor-drawn graders, starting at the center, grade the material in a windrow to the edge and back again to center, the operation continuing until uniformity of mix is secured, when it is bladed into place.

Analysis of samples taken from mix-method roadways shows that the same general principles govern these mixes as control asphaltic pavements. The principal difference appears to be in the bitumen required for binding purposes. Apparently the amount of fuel oil required is about three-fourths the quantity of asphalt that would be used for the same grading. So long as the correct amount of oil is used, it appears that wide variations in grading may be tolerated. Successful bituminous surfaces have been produced by the mixing method where the material varies from silt to crushed gravel.

An empirical formula has been developed which, while not applicable to porous or absorbent materials, such as cinders or lava, appears to give consistent results. The formula is P=.015a+.03b+.17c. In which "P" is the per cent of oil required, "a" the per cent of metal retained on the 10-mesh sieve, "b" the per cent of the metal passing 10-mesh and retained on the 200-mesh, and "c" the per cent of material passing the 200-mesh sieve.

As the stability of the surface is entirely dependent upon the asphaltic content a further gauge was developed known as the stain test. The material for the test is taken from the finished roadway, the sample warmed, and the material passing the 10-mesh sieve reserved for the test. The heated mixture is then dumped in a pile on the center of a sheet of white typewriter paper, the sample leveled to a thickness of about one inch, and another sheet of paper is placed on top. A block of wood two inches thick is then placed on top of the paper and five blows struck with a two-pound hammer, falling freely for a distance of about one foot. The two papers are then removed from the asphaltic mixture and the stain produced indicates the relative amount of oil in the sample. Satisfactory mixes will produce a light yellowish brown stain in which the impression of the individual sand particles may be distinguished and which is not blurred or blotched. A heavy stain indicates the presence of excess oil, which is not only uneconomical, but causes displacement under traffic.

Some 450 miles of the mixed type of surface has been laid at an average cost of 13 cents per square yard for a three-inch loose thickness, which cost includes labor, oil and supplies. The results experienced would indicate that under favorable conditions of drainage this type of surface will successfully carry vehicular traffic up to one thousand machines daily for a period of three or four years before retreatment is necessary. Failure at that time may be indicated either by a raveling of the surface or disintegration of the base. In the former case a light surface application, covered with stone chips should prove adequate, while mixing with additional oil is desirable in the latter.

Maintenance is very similar to that performed on the penetration surfaces, except that rolling or distortion occasioned by an excess of oil is removed through scarifying and the surplus oil taken up by adding additional material, remixing and blading to place.

TOTAL MILEAGE OIL TREATED ROADS TO NOVEMBER, 1928

District	Penetration Type				Mix Type				Grand Total
	1926	1927	1928	Total	1926	1927	1928	Total	
I	115.06	134.17	23.43	272.66	-----	-----	20.05	20.05	292.71
II	28.54	97.66	19.90	146.10	-----	-----	29.62	29.62	175.72
III	9.60	46.90	16.50	73.00	-----	67.20	31.80	99.70	172.70
IV	10.74	106.29	17.88	134.91	-----	2.60	5.20	7.80	142.71
V	1.26	11.77	22.68	35.71	-----	2.55	18.65	21.20	56.91
VI	-----	-----	-----	-----	-----	34.81	-----	34.81	34.81
VII	-----	-----	-----	-----	-----	7.50	24.97	32.47	32.47
VIII	-----	-----	-----	-----	47.97	65.60	25.06	138.63	138.63
IX	32.61	-----	-----	32.61	-----	16.40	48.94	65.34	97.95
X	4.60	60.60	26.10	91.30	-----	7.18	-----	7.18	98.48
Totals	202.41	457.39	126.49	786.29	47.97	204.54	204.29	456.80*	1,243.09

*Includes 22.56 miles of plant mix.

General. As our early efforts were confined almost entirely to existing surfaces, each method of treatment had a very definite field. Thus we find at the end of 1927 the mileage of penetration laid, to be some three times that of the mix, and that the latter type was confined largely to desert and mountainous sections where the formation was mainly granitic. However, the successful application of mixing to new surfaces, either in place on the road, or as a plant mix at the point of material production, is rapidly reducing this lead.

While the results obtained have on the whole been very successful, providing a smooth hard dustless surface resembling pavement, the public should realize this is only a type of maintenance and not a substitute for pavement. The saving in maintenance is generally reflected in that of material alone, though under certain conditions this type will postpone the need of reconstruction for a considerable period. To date some 1240 miles of roads have been treated with light oils, using some 12,200,000 gallons of oil. The following table gives in detail, the type and mileage laid each year by the various districts:

DUST PALLIATIVE

Many of our recreational roads are graded earth with dust conditions not particularly objectionable under light traffic. The increasing popularity of these routes, however, has resulted in a heavy traffic under which the dust has become not only objectionable, but hazardous as well. To meet these conditions, light fuel oil of 18 degree to 21 degree Baume gravity, containing 40 per cent to 45 per cent of 80 degree penetration asphalt is applied cold with a power distributor at the rate of one-sixteenth gallon to one-ninth gallon per square yard of surface treated. Two or three such applications, depending on the volume of traffic, are necessary during the summer period.

During the past two seasons both the light and medium grade fuel oils have been used for this purpose with marked success. The application, usually one-fourth gallon to the square yard of surface treated, is made before the road is entirely dried out and after the base has been swept with a power broom. Any surplus oil not immediately taken up by the base is covered with the roadside material. The surface is then maintained as long as possible as a sealed surface. When disintegration begins, as indicated by pot holes, the surface is lightly scarified and dragged smooth. With the heavier oils not more than two applications are necessary the first season, and but one the succeeding seasons, as a considerable amount of the oil remains in the surface. Several years of this treatment should result in very satisfactory oiled earth roads.

Oiling of this type has been performed by the following districts:

DUST LAYER, JULY 1, 1927, TO JUNE 30, 1928

District	*Miles*	*Amount*
I		$
II	27.2	4,545
III	146.0	27,769
IV		
V	5.0	4,683
VI	72.3	20,620
VII	4.4	950
VIII	11.0	3,300
IX		
X	108.8	22,873
	374.7	$84,740

OIL TREATED SHOULDERS

A low shoulder or rut along the edge of the pavement is a constant source of danger to traffic and a never-ending annoyance and expense to the maintenance organization.

Every effort is made to keep the shoulders flush with the pavement, but with only fair success. Earth dusts up and blows away when dry and ruts immediately when wet. Sand is very unstable and the rock in waterbound material breaks loose under traffic and can not be repaired satisfactorily except by reworking the entire shoulder. Oil treatment of the shoulder material is a somewhat expensive type of betterment and requires excellent maintenance but, so far, is the only solution of the problem that renders good service.

Sandy shoulders are treated by blading off the top two inches and applying one gallon of medium fuel oil to the square yard of surface. The oil is mixed in by harrowing thoroughly. The top two inches is then bladed back and another gallon of fuel oil per square yard is applied and harrowed in. A drag is then worked along the shoulder until the material is thoroughly set and compacted.

Well bound rock shoulders are sealed by the application of a tack coat of one-quarter gallon per square yard of light fuel oil after the surface has been swept clean of dust and the rock exposed. After the tack coat has penetrated, the shoulder is brought up flush to the pavement with clean rock and road oil, having 90 per cent to 95 per cent of 80 degree penetration asphalt, is applied at the rate of three-eighths gallon per square yard of surface and covered with clean screenings.

Loose rock shoulders are mixed with medium grade fuel oil following the mixing method as developed for oil mix road surfaces, detailed under "Light Oil Treatments" in this report. Shoulders are treated for a width of two to five feet, depending on traffic needs and funds available, particular attention being given shoulders along the older fifteen-foot pavements.

Considerable extension of this betterment work is proposed during the next biennium. The following table shows the mileage already so improved and the amount proposed in the various districts:

District	*Treated to date miles*	*Proposed for next biennium miles*
I	24	13.7
II	35	30.0
III	13	98.5
IV	7	35.1
V	36	16.0
VI	65	220.0
VII	7	63.6
VIII	11	121.3
IX	8	----
X	20	93.0
Total	226	696.2

SNOW REMOVAL

Approximately 18 per cent of the state highway mileage is within the area of snow fall. On 40 per cent of this distance or about 500 miles, the fall is light or is removed by special equipment so that the road is open. The balance of the mileage is on seasonal or recreational routes, and there is very little traffic demand or justification for snow removal. We do, however, prolong the use and hasten the opening of these seasonal



Slide removal by hydraulicking, in Humboldt County.



District III Maintenance Station at Marysville.



State Highway in Dublin Canyon in Alameda County.



State Highway at Ortega Hill in Santa Barbara County.



State Highway in El Dorado County being constructed by United States Bureau of Public Roads with Forest Highway Funds.



Constructing oil treated rock surfacing in Imperial County.

routes by snow removal consistent with the demands of traffic. Under this classification are those routes leading from the foothills over the "high Sierra" passes, to the sparsely settled regions to the eastward. It is probable that at some time the demands of traffic developed by the future improvement of these routes will require that snow removal be undertaken on the more important routes, however, any removal in these regions must be well conceived and executed due to the possible fatal consequences attending even a partial failure.

Where the demand exists on either main line, cross valley, or lateral routes, equipment is stationed at strategic points and crews assigned for its operation. The equipment in general consists of trucks and crawler type tractors, operating either push or rotary plows, amplified where necessary with the routine maintenance equipment such as tractors and blade graders.

In areas of heavy snowfall, operations begin with the snow and continue until the road is cleared. Trucks operating straight 21-inch blade plows under speeds of 5 to 15 miles per hour are very effective for snow up to a depth of 12 inches; for greater depths, depending on conditions of drift, either the tractor operated push or rotary plow is desirable. The following tabulation indicates the locations where normal snow conditions are encountered together with the equipment assigned and cost of removal during the 1927-1928 winter season:

The various mountain summits which are blocked by snow, with their elevation and normal date of closing and opening, are as follows:

MOUNTAIN SUMMITS

Route	Local name of highway	Name of summit	Elevation	Approximate closed period
29	Susanville lateral	Susanville summit	5,300	December 15 to February 15
25	Downieville road	Yuba Pass	*6,700	
37	Auburn road	Donner Summit	7,018	November 1 to May 1
37	Dog Valley grade	Dog Valley Summit	6,500	December 1 to March 1
11	Placerville road	Echo Summit	7,050	November 1 to May 1
23	Markleeville road	Luther Pass	7,350	October 15 to May 15
34	Silver Lake road	Carson Pass	8,600	October 1 to June 1
24	Calaveras Big Trees road	Ebbitts Pass	8,800	October 1 to June 1
13	Sonora road	Sonora Pass	9,624	September 15 to July 1
40	Tioga road	Tioga Pass	9,941	September 1 to July 15

* The Yuba Pass was closed only a few days during the season of 1927-28. It is planned to keep this pass open except during unusually severe winters. This pass is not a state highway route.

PAVEMENT STRIPING

From a modest beginning on curves as a safety measure, we are today maintaining traffic stripes on some 715 miles of pavement due to its effective aid in the safe and expeditious movement of traffic. Added to this is a considerable mileage of recently constructed pavement wherein the longitudinal construction joint serves as a permanent marking.

Pavements are marked into ten foot traffic lanes by six inch paint stripes, usually white, orange, or black in color, the latter being used exclusively on concrete pavements. While white excels in visibility, orange is occasionally used where black pavements are inclined to fatness, due to its greater effective period of coverage. The white and orange paints are lacquers applied under pressure with a hand propelled spray machine at the rate of 12 to 16 gallons per mile of stripe.

SNOW REMOVAL DATA

Route	Name of highway	Limits of work	Heavy Fall		Light fall	Total	Equipment available					Cost of work 1927-28
			Road closed	Road open	Road open		Trucks	Tractors	Graders	Push plows	Rotary plows	
3	Pacific Highway	Dunsmuir to Weed; Baird to Sims		19	31	50	2	2	1	3	1	$3,797 17
20	Weaverville Lateral	Tower House to Helena		10	21	31		1	1	1		1,785 38
28	Alturas Lateral	Montgomery Creek to State Line		63	89	152	1	2		3		3,052 04
29	Susanville Lateral	Paynes Creek to State Line	36	42	73	151	1	2		2	1	1,685 40
21	Quincy Lateral	Bush Creek to Quincy	29	9		38	1	1	1			96 04
25	Downieville Lateral*	Comptonville to North Fork			7	7	1		1			
36	Mt. Pleasant Lateral	Downieville to Mt. Pleasant	7			7						
15	Tahoe-Ukiah	Washington Road to Emigrant Gap	10			10						
37	Auburn Road	Gold Run to State Line via Dog Valley Grade	68			68	2	2	4		(*1)	1,942 50
38	Truckee River Road	Meyers to State Line via Tahoe City and Truckee	47	19		66		1		1		566 00
39	Brockway Road	Tahoe City to Brockway	12			12						
11	Placerville Road	Camino to State Line	40		14	54	2	3	3			913 52
34	Silver Lake Road	Pine Grove to Picketts Junction	54	10		64						632 12
24	Ebbitts Pass	Murphy's to Junction Route 23	51	17		68						638 70
13	Sonora Lateral	Confidence to Junction Route 23	69			69						94 90
40	Groveland Road	Groveland to Junction Route 23	27		21	48						37 39
18	Big Oak Flat Road	Carl Inn to Yosemite Park	5			5						138 38
23	Bishop Road	Bishop to Alpine Junction	171			171						675 58
63	Oasis Road	Big Pine to Oasis	39			39						
41	Kings River Canyon Road	Gen. Grant Park to Kings River Canyon	12			12						
4	Ridge Route	Grapevine Station to Tejon Pass			20	20		1		1		297 68
43	Crest Route	To Bear Lake		41	10	51	3	2		4	1	4,225 80
12	Old Spanish Trail	Boulevard to Mt. Springs			25	25						439 40
			677	230	311	1,218	13	17	11	15	3	$21,018 90

* Route to Yuba Pass.
(*1) Rotary plow from District II used to open this road in the spring.



Wire mesh and rock slope protection, Big Tujunga Wash in Los Angeles County.



Traffic stripes on State Highway in San Mateo County, near Cypress Lawn Cemerery.

For spraying operations this paint will require one gallon of thinner to every five gallons of lacquer. The black stripe is either "D" grade or petrolastic asphalt, which is occasionally covered with small sized gravel at the rate of four tons per mile. This rock coverage produces a raised stripe which is especially effective on wet nights when a strong glare is reflected from the film of water covering the pavement. In point of wear the asphalt is far superior to the lacquers, which require renewal every six to eight months. While a careful laboratory analysis is made of all paints purchased, the results are not always an accurate indication of their wear or coverage.

While the multiple zoning of pavements is admittedly an aid in the control and regulation of traffic, much of its benefit can be lost through the careless disregard of its tenets by slow moving traffic usurping the inner or fast traffic lanes. Again, on multiple zone pavements, traffic peaks in either direction may require and should have the right to use all lanes not required by the opposing traffic. These, however, are points requiring special regulation which will surely follow a better understanding of the traffic flow problem.

WARNING AND DIRECTIONAL SIGNS

By agreement all directional signs on state highways are erected and maintained at the expense of the two state automobile associations and warning signs are erected either by the Division of Highways or by the associations at state expense. It is the aim to limit the use of the highways to signs of this character only, standard in design and as far as practicable, located so that their effectiveness and benefit to the public will not be impaired.

Warning Signs. Warning signs are placed at all railroad grade crossings and curves where the vision is impaired or the change in direction is abrupt. The signals in vogue at railroad crossings include the crossing illumination; the alternate heavy diagonal white paint stripe and the words "R.R. XING" spaced on the pavement at 50 foot intervals for 300 feet each side of the crossing; the electric or gas operated flashing signal; and the particularly effective large illuminated sign suspended either side of the crossing, some 12 feet above the pavement, bearing the notation "RXR." In addition to these, many wigwag signals have been installed by the railroad companies, upon our representation.

At curves the standard warning consists of either a six or eight inch diameter red reflecting bull's-eye or a battery of nine bull's-eyes of three inch diameter, both types being readily visible some 600 feet distant. These signs are undoubtedly an aid to the careful driver, and to assure greater effectiveness and observance are placed only at points of actual necessity.

Arterial Stops. While it is true the installation of arterial stop signs have in some instances been overly ambitious, the soundness of the measure itself is best confirmed by their general observance. Early in 1927, the Division of Highways undertook to interest the various counties in their installation at important roads intersecting the highway as means of safely expediting traffic. County officials were advised

of the roads proposed to be signed and provided with copies of statutes governing their adoption. The response has been general and a great deal done to improve traffic conditions.

United States Highways. To aid interstate traffic having a definite objective in view, a committee appointed by the United States Secretary of Agriculture at the request of the American Association of State Highway Officials selected certain routes within the state system, based on their directness and safety, to be designated as United States Highways. About 2707 miles of highways were so designated.

The uniform signing of these routes was undertaken by and at the expense of the two state automobile associations. On September first of this year some 45 per cent of the work had been accomplished, involving the placing of 2422 shield markers and 439 warning or caution signs. This work, which has been performed in a most efficient and workmanlike manner, will be completed by September, 1929.

ROADSIDE ACTIVITIES

The development and improvement of the traveled way has gradually directed public attention to the necessity of adopting a similar program on the remaining area of our rights of way. This improvement both for esthetic and economic reasons has to date, in addition to tree planting, included removal of grass and brush growths constituting fire hazards, the eradication of obnoxious weeds, together with a comparatively recent program designed to insure and improve the natural beauties of the roads by the preservation of wild ferns, shrubbery, and tree growths. The activities along these lines are supervised by the arboriculturist.

Fire Hazards. The elimination of roadside growths which constitute a fire hazard is becoming increasingly difficult, as conditions vary to such an extent that no set method of treatment can be adopted.

Miles of state highway are bordered by areas so situated and influenced by climatic conditions, that they produce a varied assortment of grasses and weeds in the spring months. This growth matures very rapidly and requires only a short period of hot weather to convert it into a dangerous fire hazard, particularly menacing to adjacent property in view of its proximity to the traveled way.

Various methods of eradication have been tried out, including cultivation, mowing, scything, spraying with oils and chemicals, and burning. Of these, burning appears most effective though considerable risk attends its operation and the resulting appearance is anything but attractive. During the present year some 632 miles of roadsides were burned over by our maintenance crews in certain locations under the direction of rangers from the Division of Forestry, Department of Natural Resources, at an average cost of $36 per mile. Of this amount some twenty per cent represents cooperation furnished by adjacent property owners directly benefited by this burning. Through careful handling but six small fires resulted from these operations.

On the southerly portion of the Ridge Route the entire highway right of way for a distance of 29 miles was cleared of a heavy growth of brush and grass at a cost of approximately $15,000. However, the

recent destructive fire in that region demonstrated that even an 80 foot fire break is not effective on windy days.

The following tabulation will afford an idea of the burning operations throughout the state:

BURNING OPERATIONS ON STATE HIGHWAY RIGHTS OF WAY JANUARY TO JULY, 1928

District	Miles	Cost to state	Cost to property owners (estimated)	Average cost per mile state share	Areas burned from fires beyond control
I	33 7	$1,218 00	$120	$36	2 fires burned possibly 3 acres of cut-over brush land
II	44 4	2,612 00	100	59	No damage
III	85 4	3,311 56	200	39	7 acres of grass land
IV	60 3	2,469 00	1,200	41	50 small black walnut trees
V	21 5	722 37	250	34	25 acres grass land
VI	80 5	2,209 06	2,200	27	Possibly 100 acres brush land, no material damage
*VII	113 07	3,750 00	25	33	No damage
*VIII	95 7	3,458 00	100	36	No damage
IX	33 0	1,192 57	0	36	No damage
X	64 67	1,907 83	375	30	No damage
Subtotals	632 24	$22,850 89	$4,570	$36	
*VII	29 0	15,000 00		$517	
Totals	661 24	$37,850 89			

* In District VII an additional 29 miles on the Ridge route is being cleared at an expenditure of $15,000.
* In District VIII most of the mileage was cleared by cutting and blading rather than burning.

While the area burned has undoubtedly proved of immense benefit to the adjacent property owners, the blackened roadsides are not inviting to the motorists. During the coming biennium, it is planned to mow, rake, and burn the valley roadsides, removing the growth adjacent to the fence lines either by hand scything or burning, depending on our ability to properly protect roadside trees during the operation.

In the foothill sections where fires from the rank growth menace the adjacent grazing or pasture land, early burning will be resorted to.

Consideration is also being given to early spring spraying of roadside growths with non-poisonous chemicals which dry the plant and hasten the period of burning. This, however, due to its cost, will be tried out only where conditions preclude less expensive methods.

Obnoxious weeds. The control of obnoxious weeds is at present confined mainly to puncture vine, yellow star thistle, and mustard weed. While control is assured within the right of way, complete eradication is contingent on the adoption of effective measures on privately owned property. Since this has generally been lacking we can hope for no diminution of our present task, as the agencies of reseeding are constantly at work.

Of the weeds mentioned, puncture vine is the most serious infestation and the major share of our efforts are directed toward its control. From its original introduction in the southern portion of the state the spread has been rapid, due to the many varied and effective agencies of seed distribution. Railroad shipments from infected areas are chiefly responsible, though the sharp upward point spines, of which there are several to each burr, aid materially in their distribution by either automobiles or live stock. In general, control is exercised by applying low grade fuel oil (stove tops) with hand sprays or power spray machines



State Highway, near Riverton, in El Dorado County.



Machine finished asphalt concrete surfacing, twenty feet wide, between Lerdo and Famosa, in Kern County.

mounted on light trucks, or by hoeing and scraping once a week and burning the plants out.

The following formula has been found most satisfactory and economical for power machine applications:

Stove distillate, 25 degree to 30 degree Baume	44 gals.
Caustic soda	1 to 4 lbs.
Fuel oil (crank case drainings are suitable)	6 gals.
Water	50 gals.

Note—Hold constantly in emulsion by mechanical agitation while spraying.

During the 1928 growing season $8,813.39 was expended in puncture vine control, by the various districts as follows:

District I	$0 00
District II	530 00
District III	632 82
District IV	0 00
District V	260 00
District VI	4,590 95
District VII	1,255 82
District VIII	1,409 97
District IX	0 00
District X	133 83
	$8,813 39

This sum exceeds the 1927 expenditure by $591.

The work of puncture vine control has been carried on throughout the state in close cooperation with the State Department of Agriculture, and the respective county horticultural commissioners.

In addition to the "yellow star" numerous other species of thistles are found within the right of way and controlled by either mowing or hand cutting the plants prior to seed maturity.

Considerable success has also been had by treating this growth with a nonpoisonous commercial weed killer which is sprayed on the green plant and carried to the root system. Effective kills have been made using a spray composed of water and 3 per cent of the weed killer applied at the rate of one-eighth to one-tenth gallon per square yard of surface treated. Due to the corrosive action of the chemical special spraying equipment is necessary.

Roadside Treatments. Widespread interest now shown in the natural scenic beauty of our roadsides has injected new ideas which are bound to preserve and enhance the same. The following measures are indicative of the general procedure which is being followed in this work:

1. In daylighting a road, brush or trees are not cut on the upper side of the road where the cut bank itself prevents visibility. Exception is made in locations of heavy rainfall where accompanying winds might dislodge trees, causing damage to roadway or hazard to traffic.

2. Trees on the lower side of road are cut only when pruning will not give the desired visibility. Undergrowth, interferring with visibility, is removed; the extent of this removal to be a minimum.

3. All tree and brush cutting is done in the late fall or during the period of least traffic, and the slash burned in time to allow new growth to come up the following spring, covering both scars of cutting and site of burning.



Oil treated rock surfacing between Colfax and Gold Run in Placer County.



Multiple box culvert on State Highway in Merced County

4. When necessary to cut a tree, the cut is made flush with the ground. Existing stumps, except redwood and others of large diameter, are treated in a similar manner.

5. Ferns, flowers and moss growth on the cut bank and along the highway, except where they present a distinct fire hazard, are disturbed as little as possible.

6. Trees, shrubs, and where conditions and facilities permit, wild flowers common to the locality are planted along the fence enclosure of each maintenance station as an illustration of the state's desire for beautifying the highways.

7. The trimming and pruning of trees and brush in each district are laid out and supervised by a responsible man as instructed by the arboriculturist.

8. A section shall be selected in each district, one mile or less in length, representing average conditions, and as soon as practicable, treated as outlined above. On completion, this section to be reviewed as an object lesson by the various maintenance foremen in that district.

9. Where a distinct fire menace exists, the traveled way, to a point on the cut bank two feet above the gutter line, should be cleared of all dry vegetation.

ROADSIDE TREES

Public interest in roadside beautification is best exemplified by the fact that since 1920 civic or other public bodies have planted some 685 miles of highway roadsides to trees.

The initial expense of planting and maintenance during the first year is borne by the parties interested, the trees being secured at a nominal price from the State Nursery near Davis. At the end of this period the state assumes their entire care, and replacement in event of loss.

The extent of this responsibility is appreciated, when it is known that some $66,000 was expended during the past year for the care and replacement of the plantings, a sum representing 1.2 per cent of our maintenance allotment.

That these plantings have a utilitarian as well as aesthetic value is evinced by the recent amendment to the "Federal Aid Act," which permits the expenditure of federal aid money in the planting of shade trees, where, in the judgment of the United States Secretary of Agriculture and the State Highway Department it is practical to plant and maintain trees along the highways.

Generally the trees are spaced at 50-foot intervals, being placed alternately on the right and left sides of the roadway, with necessary elimination for visibility at crossings and road intersections. The care of these trees is very exacting and is usually assigned to the individual foreman in whose territory they occur. Assisting in the direction of this work is the arboriculturist, reporting to the maintenance engineer.

Special tree watering equipment having a movable discharge pipe enables watering to be done from the driver's seat, a tank truck of 1200 gallons usually being sufficient to water some thirty to forty trees. This watering must be performed every four to six weeks during the period from June to October. Aside from irrigation and cultivation many precautions are necessary for the protection of young trees

against insect pests, damage by squirrels, gophers, moles, and loose stock driven along the highway. The hazard of fire is also great.

Particular attention is given the location of plantings to eliminate any possible interference with the ultimate development of the pavement. With this in mind, new plantings are discouraged on rights of way less than eighty feet wide. On eighty-foot rights of way the trees are planted between the curb and right of way line, thirty-one feet out from the pavement center.

As load clearances require a clear height of twelve feet above the pavement, systematic pruning and trimming are being followed to provide this clearance and at the same time develop a symmetrical, worth while tree. Where power or telephone lines occur within rights of ways planted to trees, the tree height is limited to forty feet and all trimming for wire clearance is done by the utility company under permit and inspection of the Division of Highways.

Observations extending over a period of years indicate the suitability of the following tree species for the localities specified:

Valley sections: European Sycamore, California Black Walnut, Black Locust, Blue Gum, Red Gum, Carolina Poplar, Silver Maple, Arizona Ash, Valley Live Oak. Of these species the European Sycamore, Black Walnut, Arizona Ash, and Black Locust are preferable.

Coastal section: Coast Redwood, European Sycamore, Black Walnut, Blue Gum, Red Gum, Coast Live Oak, Silver Maple.

Desert section: Black Locust, Arizona Ash, Blue Gum, Red Gum, Black Acacai, Athol.

Owing to the susceptibility of the elm to the present widespread beetle infestation, the planting of this species in any section of the state is not advisable.

The tree plantings and their distribution throughout the various districts are as follows:

		Headquarters	*Trees*	*Miles*
District	I	Eureka	1,510	6
District	II	Redding	4,125	17.50
District	III	Sacramento	30,291	88.45
District	IV	San Francisco	16,493	242.30
District	V	San Luis Obispo	10,435	2.50
District	VI	Fresno	7,895	54.65
District	VII	Los Angeles	17,468	51.40
District	VIII	San Bernardino	27,616	142.30
District	IX	Bishop	No trees	planted
District	X	Sacramento	11,880	79.90
		Totals	127,713	685

STORM DAMAGE AND STORM PROTECTION

The repair of extraordinary storm damage and the removal of major slides are two emergency activities which test the resources of the maintenance organization each winter season. The annual expense of such work amounts to several hundred thousand dollars without considering the economic loss to traffic through delays or the necessity of traveling over detour roads.

The winter season of 1926-27 was unusually severe in extent of highway damage and value of slides. At that time it was determined that a more intensive policy of protection work was required to minimize such losses and delays. A study was made of the various methods of controlling stream erosion and slide areas and a number of projects have been completed at the most critical points throughout the state.

The cost of such work is sometimes considerable, but small in comparison to the effects of actual damage.

Perhaps the work at the Santa Clara River, in Ventura County, received the most severe test and showed its value to most advantage at the time of the St. Francis Dam disaster. The storm of February, 1927, caused the river to cut out a large area of the river bank and threatened for several days to take out the approach to the highway bridge. The encroachment of the river placed the bridge in jeopardy at every high water. To protect the highway it was decided to construct a row of concrete tetrahedrons as shown by illustration. This type of skeleton tetrahedron had been developed by Mr. Sheldon, a local property owner. These barriers are about thirteen feet high, reinforced, and weigh about seven tons each. They are fastened together by means of steel cable anchored into a large block of concrete at a safe point on the bank. Some brush was used near the bank and across the low water channel to prevent any possible cutting around the protection. The value of this construction was fully demonstrated when the thirty-foot wall of water from St. Francis Dam washed them out of line and destroyed a part of the bridge approach, but met sufficient resistance so that there was a minimum damage to the highway and the highway bridge itself.

Another type of tetrahedron built up from railroad rails has been constructed at the San Felipe wash in Imperial County. These tetrahedrons are anchored and tied together with old wire cable. This type of construction effectively catches debris and drift, and obstructs the flow of water, even when undermined and overturned, sufficiently so that silt is deposited and the channel back of the protection work gradually filled.

In Orange County the heavy flood of February, 1927, cut out a large area of land along the Santa Ana River just north of the Chapman Avenue bridge. The wooden pile and wire revetment near the bridge was destroyed. A 2000-foot section of protection work made up of two rows at four-foot centers of woven wire fencing with iron pipe posts and bracing was constructed at this point. Three-inch galvanized tubing was used for the posts, which were driven about thirteen feet into the ground and projected six feet above the surface. Diagonal braces of the same material were placed along the front row and a brace to alternate posts of the rear row thoroughly tied the framework together. The woven wire fencing extended three and one-half feet into the ground and to the top of the posts. The space between the two rows was filled in with brush and rock to weight it down. This type of protection has been very effective and is being used at several other similar danger points.

Near Pepperwood, in Humboldt County, the Eel River seriously endangered the highway. The drift in this stream is heavy and the current strong at the foot of a high bank. At this point, for a distance of about 800 feet, two rows of piling were driven paralleling the face of the bluff. At each end and every two hundred feet between, a row of piles was driven at right angles and extending well into the bank. The piles were thoroughly sway-braced and a row of lagging and a wire cable placed near the top for the full length of the work. Barbed wire on four-inch centers was placed for the full length of the piles.

At another point in this vicinity the river had washed out a portion of the roadway, leaving only a single track road which was endangered at every high water. It was not advisable to cut further into the bluff because of the danger of starting slide material. The fill was therefore widened out and protected from the stream erosion by means of slope paving built up from sacked concrete. The sacked concrete is economically handled and once in place and set forms a homogeneous mass not easily displaced.

Considerable advance has been made in handling slide control work. Along the Redwood Highway, in material which can be sluiced, the use of the "hydraulicking" method as developed by the early miners has been adapted to removing the slides and in cutting ravines to drain the overburden and keep the earth from coming into the roadway. At a number of locations preventive measures, such as trenching at the toe of slides and placing of perforated pipe and rock to provide drainage, have been developed with economical results.

It is the purpose to continue the study of such dangerous or difficult situations on the state highways as it is believed the public is better and more economically served by a prevention type of maintenance.

PERMITS

In the early acquisition of rights of way, a sixty-foot width appeared ample, as the present 6100 per cent traffic increase was hardly contemplated. Recognized as inadequate this width has been expanded to eighty feet and on major routes to one hundred feet. Even with these widths a well established policy is necessary to insure the ultimate pavement development with a minimum disturbance of those correlative features such as trees, sidewalks, and public utilities which more or less attend traffic and roadside development. Recognizing the necessity for regulating the activities of outside interests within these 54,000 acres of rights of way, the legislature has from time to time enacted certain laws tending to aid the Division of Highways in their scheme of development. This regulation is handled through written permits, its scope including not only the movement of overweight and overwidth loads, but encroachments by structures, pole lines, service





State Highway on the Crest Route in San Bernardino County. A cooperative Forest Highway Project being constructed by the United States Bureau of Public Roads.



State Highway along the coast in Ventura County

utilities, and advertising as well. The extent of this phase of the work is shown by the 8232 permits issued during the past two years.

The investigation in connection with requests for permits and the inspection of work performed under such authority is handled, in the main, by the maintenance field forces. In two districts the volume of work requires a regular inspector. The permits are prepared by the district offices and the majority issued directly. In special cases the approval of central office is required. All encroachment permits, however, are considered with reference to their compliance with the accompanying illustration of the right of way development.

Two standard forms of permits have been adopted within the past year, the encroachment permit and the transportation permit. The first is used to cover any work or encroachment on the right of way and the second, the moving of special loads, buildings, etc., over the highways. Each type has printed thereon all essential standard and special provisions. The forms are designed to not only minimize the work of their preparation, but also standardize the requirements expected of each permittee throughout the state. The issuing of permits is very carefully supervised as the protection of the pavements from excessive loads, the safety and convenience of traffic, and the limiting of interference with future traffic and construction needs are constantly in mind.

The principal statutes which give this regulatory authority are as follows:

1. *Issuance of permits.*

Chapter 99, Statutes of 1915: Provides for regulating openings, structures, pipes, trees, etc., on state highways, and issuance of permits by the State Department of Engineering.

This act forbids work of a nature outlined above except under authority of a permit. It provides that a bond may be required in connection with permits at the discretion of the granting authority. It also provides that work of this nature done without permit is a misdemeanor.

2. *Protection of state highways.*

Chapter 400, Statutes 1915: An act to provide for the care, management and protection of state highways and providing penalties for violations of the provisions of the act.

It provides authority for: removal of fences, structures, or other encroachment; penalty for diversion of watercourse or drainage of water to the injury of the highway; bridges over irrigation ditches, etc., and wilful injury to any bridge; removal of dead animals on highway; removal of advertisements; penalty for cutting down, or injury to trees.

3. *Overweight and overwidth loads, tractors and trailers.*

Chapter 266, Statutes of 1923 as amended by chapter 240, Statutes of 1925 and chapters 752, 844, and 864, Statutes of 1927, known as the California Vehicle Act.

This act forbids the operation of any vehicle having cleats or protuberances on the wheels, or any vehicle over a specified weight or a

specified width, or the operation of more than one trailer without a permit from the Department of Public Works.

The police power necessary to the enforcement of the provisions of permits issued under the California Vehicle Act is vested in the Division of Motor Vehicles of the Department of Finance.

TRAFFIC CENSUS

The purpose of the maintenance organization is to serve traffic. To fulfill this obligation the highways must not only be preserved in the best condition, but information as to the rate of development of traffic must be collected so that expansion of transportation facilities will be in advance of traffic needs. With this end in view a special study has been made of the traffic problem during the past two years.

While traffic counts taken each year in January and July provide records of existing traffic, any worthwhile recommendation requires an approximate determination of the traffic capacity of two, three, and four lane pavements, also an estimate of the probable increase in traffic on any given section of road.

On every heavily traveled road there is a period in the morning and late in the afternoon when travel is heaviest. Analysis of actual hourly records for all sections of the state show that for nearly 90 per cent of the stations the traffic during the peak hour was from 9 per cent to 11 per cent of the total traffic from 6 a.m. to 10 p.m. For practical purposes the peak hour traffic may therefore be accepted as 10 per cent of the 16-hour count.

The next step was to determine the volume of traffic which might use the highway during the peak hour without undue interference. This quantity is influenced by a number of variables, such as condition of the road, alignment, intersections, range in braking distances, percentage of fast and slow vehicles, personal equation of each driver, etc. It is evident, therefore, that any figure adopted must be based on arbitrary assumptions. In making such assumptions in our study, consideration has been given to records of actual performance, experience, and observation.

The planning for pavement width to care for the estimated future traffic requires that the traffic capacity be taken at some definite figure. The range of driving speeds and other factors is so great that practical working capacities vary widely. At the expense of police control, increased danger of accidents and of delay, expense and inconvenience to users of the highways, traffic of 2000 vehicles per hour may be passed over a single lane roadway at 20 to 25 miles per hour. However, a single vehicle traveling at a speed of two miles per hour would reduce the capacity of our single lane to 330 vehicles per hour. At 50 miles per hour it is theoretically possible to pass 2400 vehicles per hour over this single lane in the same direction.

Alignment, gradient, proportions of light and heavy traffic, weather, driving conditions, and the personal equation of different drivers all enter into the question of establishing a guide for the proper economical planning of roads for maximum service. These different phases of the problem have been carefully considered in the light of traffic records and actual field conditions, and the following capacities have been

arrived at for the purpose of determining the width of pavement necessary to care for the estimated traffic in 1940:

	Vehicles per hour
Two lane roadway	700
Three lane roadway	2000
Four lane roadway	3200

These are considered to be the peak hour traffic figures and represent 10 per cent of the traffic for the 16-hour period from 6 a.m. to 10 p.m. This volume of traffic will permit fast traffic to travel at 40 miles per hour and provides for sufficient safe passing space for that purpose. It provides for a safety factor of about 30 per cent, that is, traffic on a two-lane roadway can be increased to 1000 vehicles per hour without serious delay.

Consideration was also given to rate of traffic increase. This is dependent on increase in population, increase of vehicles in proportion to population, increase in traffic from outside the state, and increased use of vehicles as the highways are improved. For our purposes, after analysis of existing data in the above respect, it seemed reasonable to assume that the increase in traffic would continue at the present rate of nearly 9 per cent annually for the next 12 years without extreme change. Traffic assumptions as of 1940 were worked out on an average of 9.6 per cent annually over the 1926 count.

TRAFFIC COUNT RECORDS

Records of traffic on state highways are available since 1920 when the United States Bureau of Public Roads and the California Highway Commission in cooperation with 24 counties undertook a state wide study. This work was continued in 1922 and a report published. In 1924 the Division of Highways assumed entire control of the work and since that time semiannual counts have been made at a system of stations by the maintenance organization. Counts are made in January and July as being representative of the maximum and minimum periods of the year.

In the following table of traffic census on the state highway system there is shown the count of vehicles at representative points along the various routes of the state highway system for the years 1922, and 1924 to 1928, inclusive. The 1922 count was taken at various times of the year, but the figures shown are for peak traffic where available. The figures for the other years were taken during July or August and represent the Sunday counts. These counts are for the 16-hour period from 6 a.m. to 10 p.m. which covers approximately 92 per cent of the traffic for a 24-hour period. The total count of all vehicles is shown. The actual field records segregate traffic into types. Separate record is made of automobiles, light trucks, heavy trucks, trailers, buses, tractors, and horse-drawn vehicles.

Our investigations have shown that the direction of travel during morning and evening peak hour is as follows:

	Morning per cent	Evening per cent
Toward town	70	40
Away from town	30	60

TRAFFIC CENSUS ON THE STATE HIGHWAY SYSTEM—1922 TO 1928

LOCATION OF STATION	1922	1924	1925	1926	1927	1928
ROUTE 1 SAN FRANCISCO TO OREGON LINE						
Sausalito S. P. Ferry	1632			6609	6591	8677
San Rafael North of City	1389	5867	8134	8435	8965	12138
Santa Rosa South of City	1439	4276	4708	4025	4191	4406
North of City	3467	4240	4207	2674	5101	5377
Healdsburg South of City	1275	3401	3411	3312	3691	4055
McDonald Jct. Rt. 42 South	228	1028	684	358	1284	1481
North	145	1593	891	1201	1545	1413
Healdsburg Jct. Rt. 14 South	1417	1736	1177	1489	1666	1871
North	1401	1476	1760	1397	2552	2525
Ukiah Jct. Rt. 10 South	238	1832	1742	1414	1556	1704
North	271	1815	1746	1781	2509	2578
Ukiah Jct. Rt. 14 South		1477	1830	2023	2301	2554
North		1147	1951	1531	1721	1777
Willits North of City						
Jct. County Road	940	894	1341	1050	1179	1135
Cloverdale Jct. County Road to South Fork	564	1381	1183	1112	825	1516
Ukiah Jct. Rt. 10 South	831	1737	1447	968	2481	1448
North	854	1414	1440	1715	1731	1448
Eel River Near Scott				541	487	641
Crescent City Jct. S. R. of City South	178	318	345	654	746	1060
East		141	235	504	751	1044
ROUTE 2 SAN FRANCISCO TO SAN MATEO						
Colma	77	14187	20440	18804	18807	43866
San Bruno Jct. Rt. 42 North	5270	17280	17036	15612	21102	22309
South	7877	14852	14981	17116	23538	45815
Redwood City North of City	4470	18765	20115	17749	19001	34414
San Jose North of City	6183	13545	15674	13643	12328	20548
South of City	4776	7478	7445	6355	8121	10151
Gilroy Jct. Rt. 12 North	2016	2563	2262	2006	2736	3814
South	1151	1785	1677	1728	2411	2547
San Juan Bautista Jct. Rt. 17 North		5944	4307	5451	6021	5126
South		1724	1442	1454	1803	1431

LOCATION OF STATION	1922	1924	1925	1926	1927	1928
San Juan Bautista Jct. Rt. 25 North	1254	4278	3259	4180	4257	4658
South	365	3069	2515	3085	3590	3496
Holiday Count shown to here for 1922.						
Salinas North of City	2175	3112	3682	4987	5475	6229
San Lucas Jct. Rt. 10 North	732	1743	1595	2078	2177	2329
South	696	1703	1041	3045	2135	2850
Paso Robles Jct. Rt. 33 North	800	2103	1830	2119	2509	2730
South	1179	2997	2807	3307	4422	3483
San Luis Obispo	1477	4193	3534	4205	4132	3665
North of Santa Maria Jct. Rt. 37 North	843	2828	3151	3582	4624	4036
South	895	2833	3185	3534	4248	4052
Buellton	851	2527	2500	2730	2808	2879
Santa Barbara North of City	1745	5629	5361	5121	5221	5260
South of City	5762	6786	12887	7957	8479	9524
♦ 1925 count due to earthquake						
El Rio Jct. Rt. 60 North	1590	3117	2971	5128	6178	6023
South	3980	5700	4941	5715	5341	7603
E of Hollywood Jct. Van Nuys Blvd North	6129	9280	12641	7700	abandoned.	
South	4852	7847	11678	10489		
W of Hollywood at Sunset Blvd.					11853	11702
Los Angeles City Whittier-Jct. Hadley	6371	8683	10709	12333	12353	15216
Santa Ana North of City	11872	8898	14172	14151	12911	12567
San Juan Capistrano North of City	1302	4419	4930	5472	7168	4945
Del Mar At Santa Fe R R Xing	2103		4995	5816	6195	8005
ROUTE 4 SACRAMENTO TO OREGON LINE VIA MARYSVILLE						
At Jct. Golden Highway	7077	10004	4528	10325	11693	13690
Roseville Jct. Rt. 17 South	1712	4344	4744	4561	5212	6016
North	703	1750	1452	1492	1527	2414
Bear River Bridge	930	2438	2885	1195	Abandoned	
Marysville Jct. Rt. 15 So. of Cy.	1714	2038	3152	1838	2050	2869
Yuba City Jct. Rt. 15 South		3237	3152	4169	3772	4750
North		2214	2165	2535	2486	2722

LOCATION OF STATION	1922	1924	1925	1926	1927	1928
Richvale Y Jct. Rt. 21 South	906	1066	1179	1251	1368	1746
North	1162	1088	1122	1286	1247	1298
Chico North of City	1630	1816	1801	1725	2136	2109
Red Bluff Jct. Rt. 29 South	569	1013	1073	699	1250	1446
North	671	1004	1244	747	1267	1662
Redding Jct. Rt. 28 South	682	1802	1948	1771	2032	2301
North	994	2172	2591	2157	2508	2585
Dunsmuir North of City		2590	3097	3907	3883	3700
Gray Jct. Rt. 46 South	400	1121	1139	1476	1513	1604
North	400	1087	1185	1309	1444	1598
At Oregon Line		1076	1246	1434	1465	1563
ROUTE 4 SACRAMENTO TO LOS ANGELES						
Sacramento South of City Limits	1598		6143	5986	7004	7174
Twin Cities Jct. Rt. 34 North			3659	3768	3375	3706
South			3702	3793	4405	4131
Lodi Jct. Rt. 24 North	1868		2763	2831	2376	3118
South	2763		1744	4120	4830	4413
Stockton North of City	3510		5045	5865	6194	6111
French Camp Jct. Rt. 5 North	1854	2868	3212	3561	2803	2441
South	993	480	1064	1768	1079	1235
Manteca Jct. Rt. 6	2363	2075	2014	2528	4196	4117
Salida Jct. Rt. 14 North	2331	4187	3572	3076	4872	5311
South	2160	4090	4248	4531	4967	5330
Merced Jct. Rt. 18 North of City	2125	3465	3060	3464	4221	5207
South of City		2720	3093	3154	4241	4572
Califa Jct. Rt. 12 North	1515	2048	1342	1590	2435	2585
South	1566	2445	1875	2569	3078	3309
Fresno North of City	4406	4834	4126	7738	*3729	*7056
South of City	6654	8708	7498	6084	*8131	*5487
Goshen Jct. Rt. 10 North	2122	2565	2302	2461	3057	2870
South	1394	2241	1814	1713	1826	2345

*Not at gage station but in approximate vicinity.

TRAFFIC CENSUS ON THE STATE HIGHWAY SYSTEM—1922 TO 1928—Continued

LOCATION OF STATION	1923	1924	1925	1926	1927	1928
[illegible]						
[illegible] East of City	3220	3394	3647	3972	4113	4754
[illegible] West of Y Junct. Rt. 7		2938	3[illegible]	[illegible]	4538	4951
[illegible]						
[illegible] South of City	729	1134	1232	1293	1435	1542
[illegible] Oakland Junct. Rt. [illegible] North	982	874	1348	1402	1571	1956
South	874	1110	1247	1373		
[illegible] Willows- Jct. Rt. 45 South [illegible]	633	1358	1425	1647	1737	1836
[illegible] Williams Jct. Rt. [illegible] South of City	567	1174	1489	1330	1423	1648
[illegible] Woodland South of City	1951	2416	2474	3401	2679	3146
[illegible] Woodland Jct. Rt. [illegible]	1548	2765	2031	2822	3269	3666
[illegible] Fairfield East of City	3422	3820	3904	4175	5093	5418
[illegible] Vacaville Jct. Rt. [illegible] South	329	4288	4182	4516	5293	5940
South	175	870	934	979	826	1051
[illegible] Dixon North of City	144	700	903	1013	794	779
ROUTE 8—SACRAMENTO TO DOS PALOS VIA LODI						
Schellville Jct. Rt. [illegible]		2323	2847	2712	2827	3[illegible]
[illegible]		2149	2579	1582	1941	2[illegible]
Napa Junction Jct. [illegible]	704	5273	5663	5727	7736	8[illegible]
[illegible]	542	3591	3645	3921	9502	1[illegible]
Cordelia Jct. Rt. [illegible]		3644	3484	3643	4718	5[illegible]
[illegible] SAN FRANCISCO TO SAN BERNARDINO						
[illegible] West of San Fernando	3[illegible]	3176	[illegible]17	[illegible]72	2721	[illegible] co.
[illegible] Los [illegible]	1[illegible]	14535	[illegible]137	[illegible]37	10634	[illegible]

LOCATION OF STATION	1923	1924	1925	1926	1927	1928
[illegible]						
[illegible] East of City	2592	3640	3926	4006	4582	3899
San [illegible] Junct. Rt. [illegible]	2403	4247	4201	4[illegible]	5[illegible]	5[illegible]
[illegible] SAN LUCAS TO SEQUOIA [illegible]						
San Lucas Junct. Rt. [illegible]	52	5[illegible]	110	106	123	1[illegible]
Coalinga West of City		470	400	435	442	3[illegible]
Hanford West of City	1182	1864	1607	1528	1602	20[illegible]
Goshen Junct. Junct. Rt. [illegible]	750	1244	1239	1239	1468	2[illegible]
Visalia Y Junct. Rt. [illegible]		3392	777	3602	4220	4[illegible]
Lemon Cove Jct.		500	567	1574	1907	1894
Three Rivers East of Town		267	471	1[illegible]	1[illegible]	1[illegible]
[illegible] SACRAMENTO TO NEVADA STATE LINE VIA [illegible] VILLE						
Sacramento East of City	1921	3644	3475	3454	3811	4352
Perkins	1394	2560	2436	2414	2952	3035
Folsom West of City	600	2365	1436	1727	1992	1774
Placerville West of City	578	1430	1754	1315	1334	2175
Between Sumerton and Pyramid		438	423	1040	1132	1112
Myers Jct. Rt. [illegible] East	171	71	31	526	930	563
West	57	67	83	218	451	166
Nevada State Line	526			235		324
[illegible] SAN DIEGO TO EL CENTRO						
San Diego East of [illegible]		6065	8336	9446	4382	
Spreckels Bridge		2036	1791	1884	2035	1558
[illegible] at Jct. [illegible] to Otay		918	1255	1146	1271	1[illegible]

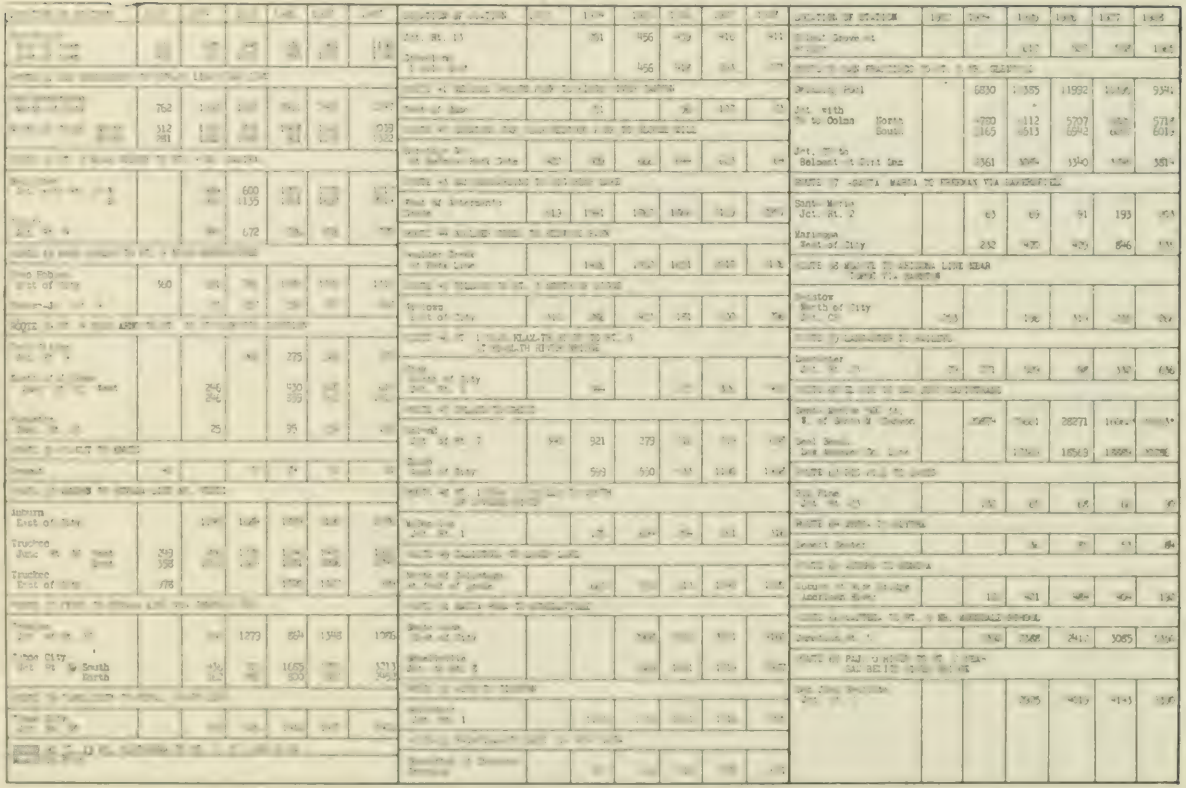
TRAFFIC CENSUS ON THE STATE HIGHWAY SYSTEM—1922 TO 1928—Continued

LOCATION OF STATION	1922	1924	1925	1926	1927	1928
El Centro Jct. Rt. 2, West		1201	1919	2143	2448	2490
East		1083	602	476	484	733
ROUTE 11 SALIDA TO MT. 26 AT JUNCTION						
Salida Jct. Rt. 4		[illegible]	438	1311	431	380
East of Salida at Modesto Jct. to Modesto		1848	1936	1931	1358	1385
Oakdale East of City		1134	1317	1583	1368	1496
Mountain Pine Jct. Rt. 40 to Yosemite SW		556	1311	1284	1404	790
NE		798	937	929	1241	1084
Sonora		1937	1921	1625	1806	1804
ROUTE 14 ALBANY TO MARTINEZ						
Albany Alameda County Line	6872	15795	18116	19831	22683	21947
Junction SR to Richmond	1737	11623	12798	15301	17364	18329
Junction of Franklin Canyon Rd. South	1606	5843	5721	7128	12403	10741
North	1373	4151	4894	5485	8542	8862
Concord 1 mi. So. of City	498	1065	1474	1052	2656	1930
Martinez W. of City Limits	290	899	1161	1339	1595	1313
ROUTE 15 FROM RT. 1 NEAR CALAPOOLA TO RT. 37 NEAR UKIAH						
Ukiah Jct. with Rt. 1		698	951	921	1049	829
Mendocino Lake County Line			523	444	545	
Near Nevada Jct. SR to Bartlett Springs			75	132	102	167
Williams East of City	297	689	481	537	471	458
ROUTE 16 HIGHLAND TO LAKEPORT						
Highland Jct. to Rt. 1	307	667	857	998	786	776
Lakeport South of town Jct. SR to Kelseyville NE	430		1022	1118	1282	1494
W	351		270	321	378	492

LOCATION OF STATION	1922	1924	1925	1926	1927	1928
ROUTE 17 ROSEVILLE TO NEVADA CITY						
Roseville East of City	953	2682	3394	3394	3549	4761
Loomis East of City	357	2393	2958	2825	abandoned	
Auburn	353	2416	3225	3009	4430	4367
Grass Valley South of City	135	1416	1435	1445	1651	1405
Nevada City South of City		1378	1400	1535	1598	1594
ROUTE 18 MERCED TO RT. 40 NEAR SEQUOIA						
Merced 18th St. E. at Intersection of SP to La Grand	291	787	347	394	964	1847
Merson Bar	95	207	462	476	2231	2413
ROUTE 19 FROM RT. 9 WEST OF EL MONTE TO RIVERSIDE						
Pomona at Chino Grade Road West	7695	7920	5711	5063	10920	9642
East	7184	7540	9635	4321	6559	9965
Wineville East of City	875	5104	3615	3334	5437	4646
Riverside Nr. Santa Ana River Bridge	2509	4821	5308	1232	7165	6554
ROUTE 20 RT. 1 NR. ARCATA TO REDDING VIA WEAVERVILLE						
Between Redding and Tower House	162	95	195	235	197	310
ROUTE 21 RT. 3 NEAR RICHVALE NEAR QUINCY						
Richvale Y		466	360	486	366	382
ROUTE 22 SAN JUAN BAUTISTA TO RT. 32 VIA HOLLISTER						
San Juan Bautista at Jct. of Rt. 2		2053	2284	2638	2209	2662
Hollister Jct. Rt. 32		640	646	775	971	1130
ROUTE 23 SAUGUS TO RT. 11 AT ALPINE JUNCTION						
Saugus Jct. with Rt. 4		3242	3861	4526	3661	4733
Lancaster Jct. with Rt. 59	518	459	759	1152	1216	1410
Big Pine Jct. to Rt. 63	347	229	212	709	717	983

LOCATION OF STATION	1922	1924	1925	1926	1927	1928
Markleeville Jct. to Rt. 24		10	30	84	92	47
Pickett Jct. to Rt. 94		84	103	110	218	137
ROUTE 24 RT. 4 NR. LODI TO RT. 25 NR. SILVER CREEK						
Lodi Jct. Rt. 4			1124	1519	1333	1548
Betw. San Andreas and Valley Springs		141	405	545	769	767
Douglas Flat East of Angels Camp			392	408	133	
ROUTE 25 NEVADA CITY TO GRASS VALLEY						
Nevada City North of City		97	156	454	361	382
Boomtown North of City	52	96	133	344	260	289
ROUTE 26 SAN BERNARDINO TO EL CENTRO						
San Bernardino South of City	1967	2930	1756	2207	3456	3234
Southeast of Redlands North	693	1637	1670	2007	2453	2345
South	456	1247	1145	1260	1826	1746
Banning N. W. of City	886	1364	1618	1224	2243	2130
Coachella North	312	831	550	1005	1085	1301
South	589	993	525	794	785	945
El Centro West of City Jct. Rt. 12	1220		1376	2578	2226	2477
ROUTE 27 EL CENTRO TO YUMA						
El Centro East of City West	1340	472	1634	1649	1936	2276
East	1071	509	1433	1680	2314	2176
East of Holtville	400	139	367	1002	1182	1504
ROUTE 28 REDDING TO NEVADA LINE VIA ALTURAS						
Redding South of City	358	457	574	488	624	567
Between Canby and Alturas	121	96	165	155	132	213
East of Cedarville	40		78	172	61	63
ROUTE 29 RED BLUFF TO NEVADA LINE NEAR FORKS						
Red Bluff	128	186	238	319	411	652

TRAFFIC CENSUS ON THE STATE HIGHWAY SYSTEM—1922 TO 1928—Continued



and that the peak hour traffic is about 10 per cent of the total count for the 16-hour period.

A comparison of the counts as shown by the table indicates an increase in traffic during the past four years of 35 per cent. Using the 1924 count as a basis, the traffic for each year was as follows:

	Per cent
1924	100
1925	110
1926	114
1927	127
1928	135

The information made available is in daily use by the highway organization in planning improvements and allotments of funds. Many commercial and service organizations make use of the detail in their work.

COST ANALYSIS

In the design of the accounting system the needs of the maintenance work were fully considered so that the cost of the various phases of the work might be readily analyzed for purposes of study and comparison.

The information developed is used primarily in connection with our study of the needs of a particular road, and is applied in connection with the known facts as to condition of the road, volume of traffic, climatic situation, etc. California covers such extremes of climate and traffic that an average figure of cost per mile for maintenance must be considered in the light of such information to be of value.

An analysis of 1927 expenditures shows the distribution of the maintenance dollar on state highways as follows:

Class of work	
Where spent—	Amount of each dollar spent
Traveled way	54.5 cents
Roadside	30.7 cents
Improved shoulders	3.0 cents
Structures	6.4 cents
Safety devices	2.0 cents
Drifts	0.6 cents
Trees	1.2 cents
Miscellaneous	1.6 cents
Total	$1.00

Class of expenditures	
Labor	44.2 cents
Equipment costs	32.8 cents
Materials	20.6 cents
Service and expense	2.4 cents
Total	$1.00

At the end of this appendix will be found a table showing maintenance fund expenditures, including not only general maintenance, but also improvement and reconstruction, distributed by counties and routes.

MAINTENANCE FUNDS AND EXPENDITURES

At the time recommendations for the biennial budget of the Division of Highways are under consideration the maintenance engineer, in conference with other engineers of the headquarters staff, makes the recom-

79th FISCAL YEAR PROGRAM (TYPICAL SETUP)

District	(1) Miles	(2) General maintenance	(3) Purchase and repair small tools	(4) Trees	(5) Depreciation on maintenance station building	(6) Major slide removal*	(7) Specific maintenance*	(8) Oil processing rock surfaced roads*	(9) Maintenance stations*	(10) Totals
I	567	$274,995	$6,000	$450	$1,370	$210,615	$97,147	$170,540	$19,290	$780,407
II	866	363,720	4,000	2,900	1,260	65,140	58,855	99,400	9,380	604,655
III	869	408,430	4,000	17,200	1,250	28,805	57,577	101,374	6,775	625,411
IV	476	337,950	4,000	4,600	2,150	73,135	55,809	90,577	9,630	577,861
V	539	253,330	1,000	900	450	12,086	37,530	48,585	22,625	376,456
VI	626	269,180	3,000	16,800	1,920	6,500	44,470	3,300	10,591	355,761
VII	537	351,735	4,000	7,400	1,320	16,640	100,178	12,500	6,610	500,383
VIII	823	407,385	6,000	1,800	795	11,963	51,491	16,611	24,739	520,784
IX	439	175,600	2,000	.....	350	.....	4,700	64,218	8,284	255,152
X	714	335,580	4,000	13,600	540	6,850	35,394	57,883	3,900	457,737
Totals	6,456	$3,177,915	$38,000	$65,650	$11,395	$431,734	$543,151	$664,938	$121,824	$5,054,607
Governor's budget for biennium $6,600,000*	.....	.....	.....	.....	.....	$800,000	$900,000	$780,000	$500,000	$9,580,000

* In these subdivisions no advance program was made. The amounts shown are actual allotments for the fiscal year, based in general on emergency needs which could not be deferred.
* This amount provides for the totals in columns 2, 3, 4, and 5 as allotted.

mendations for maintenance requirements to be incorporated in the budget.

At the beginning of each fiscal year maintenance funds are programmed according to the class of work performed. A typical setup for one year is shown by the following table which covers the actual allotments by districts for the seventy-ninth fiscal year, July 1, 1927, to June 30, 1928:

It will be noted that in some classes of work the allotments exceed one-half of the setup in the governor's budget. The work for the eightieth fiscal year must be limited accordingly or emergency authorizations provided in due form.

The expenditures under the various headings shown above are kept according to the budget items of maintenance and reconstruction. These expenditures are shown by years in the following table:

STATE HIGHWAY MAINTENANCE FUND EXPENDITURES BY FISCAL YEARS

Fiscal years, July 1 to June 30	Reconstruction and improvement	Maintenance	Plants, equipment, administration, suspense	Total	Receipts
1914–1915		$98,355 80	$101,230 90	$199,586 70	$467,690 60
1915–1916		834,843 50	218,824 08	1,053,667 58	777,077 33
1916–1917		804,031 76	46,299 30	850,331 06	803,987 21
1917–1918		703,111 84	100,980 60	804,092 44	1,100,568 80
1918–1919	$300 64	1,220,254 07	130,231 84	1,350,786 55	1,465,939 50
1919–1920	21,592 28	1,457,912 72	42,581 59	1,522,086 59	1,924,299 77
1920–1921	19,201 25	2,167,557 72	226,646 15	2,413,405 12	2,434,800 57
1921–1922	18,609 15	3,596,359 53	93,938 04	3,708,906 72	3,018,192 36
1922–1923	46,298 08	3,840,738 98	204,937 33	4,091,974 39	3,785,054 95
1923–1924	1,836,264 68	3,819,333 59	507,922 83	6,163,521 10	7,645,337 74
1924–1925	4,369,895 64	3,655,028 22	837,147 05	8,862,070 91	9,434,270 58
1925–1926	6,177,279 68	3,780,470 18	732,185 73	10,689,935 59	10,934,875 12
1926–1927	6,815,888 53	5,656,244 73	—290,746 46	12,181,386 80	12,171,691 01
1927–1928	7,066,121 67	4,462,993 83	1,253,117 15	12,782,232 65	13,867,667 96
Totals	$26,371,451 60	$36,097,236 47	$4,205,296 13	$66,673,984 20	$69,831,453 50

MILEAGE UNDER MAINTENANCE

State highways and state parks. A tabulation of the mileage of state highways under maintenance, segregated by districts and type of road surface is shown. It will be noted that this tabulation includes roads in state parks which have not previously been considered in maintenance department setups. Chapter 267 of the Statutes of 1923 specifically authorizes the use of money from the state highway maintenance fund for the maintenance, repair, widening, resurfacing, and reconstruction of roads and highways in state parks subject to the approval of the official charged by law with the control and management of such parks. This class of road will be materially increased with the acquisition of additional parks and greater volume of traffic which will develop as these areas become better known.

MILEAGE OF STATE HIGHWAYS UNDER MAINTENANCE BY DIVISION OF HIGHWAYS, JUNE 30, 1928

DISTRICT	CONCRETE	OILED CONCRETE	ASPHALTIC CONCRETE	BITUMINOUS MACADAM	OILED ROCK	ROCK	EARTH	BRIDGES	TOTAL	STATE PARKS+
I	31.106	0.511	0	7.701	158.052	94.072	56.269	3.542	351.253	3.10
II	113.518	3.385	0	2.560	158.777	168.525	408.492	1.836	857.013	4.70
III	151.852	87.279	11.741	94.593	144.155	75.732	332.467	•	897.819	1.35
IV	137.580	25.530	113.890	45.460	208.530	39.430	77.870	0.530	649.020	6.00
V	176.260	50.964	30.075	18.950	39.791	29.519	128.517	1.425	484.501	0
VI	200.757	49.421	116.134	51.048	32.626	0	173.057	1.458	624.511	0
VII	381.990	34.90	47.557	47.985	13.306	0	93.993	•	519.731	0.057
VIII	145.765	9.602	74.473	31.965	104.235	0	456.010	1.508	823.558	0
IX	8.710	0	0	8.37	25.56	2.220	393.750	0.120	438.730	0
X	119.950	19.384	65.742	58.003	116.582	55.390	278.756	6.240	724.047	0
TOTAL	1,366.608	290.876	459.612	366.635	1,001.714	468.888	2,399.191	16.659	6,370.183	14.807

• Length of bridges included under mileage by type.
† No charges on these roads prior to June 30, 1928.

STATE HIGHWAY MAINTENANCE FUND EXPENDITURES

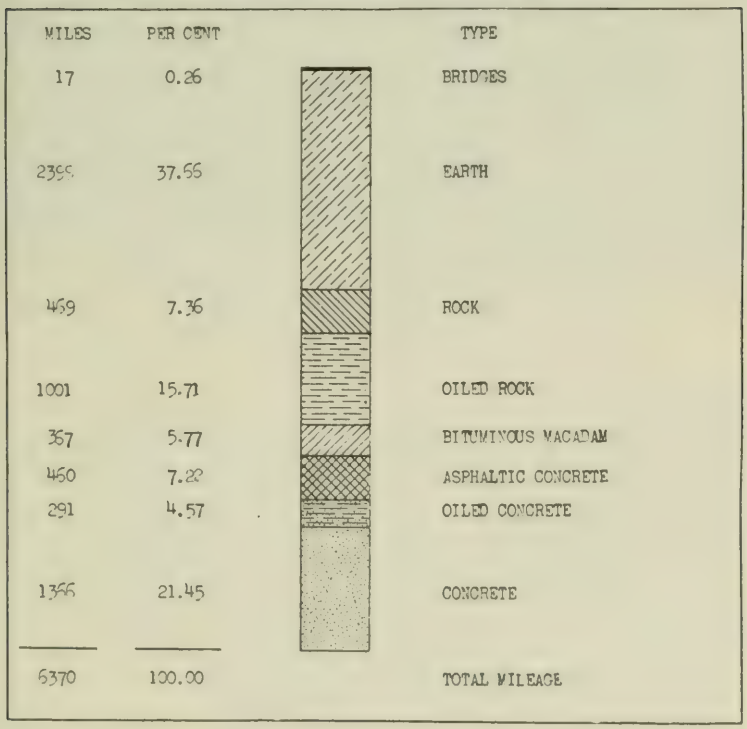
County	Route	Miles under Maint.	General Maintenance	Improvement and Reconstruction	Total
Alameda	5	57	$ 959,305.40	$ 574,388.47	$ 1,543,694.87
Alpine	23	24	56,936.90	25,476.35	82,412.26
"	24	35	56,815.36	42,006.23	37,821.59
"	34	14	23,735.32	14,876.40	38,611.72
Amador	34	75	358,231.53	112,573.94	480,805.47
"	34	9	24,448.67	8,205.83	32,654.40
"	55	18	35,418.38	35,572.21	71,991.13
Butte	3	45	176,463.78	41,535.40	218,430.18
"	21	43	51,122.53	7,525.84	58,728.47
"	45	10	13,543.11	3,301.44	16,844.55
"	47	6	42,141.67	15,345.25	57,186.92
Calaveras	24	58	186,450.53	23,552.81	210,403.34
"	55	31	44,572.43	28,651.94	73,134.37
Colusa	7	84	191,996.59	37,011.31	228,110.90
"	15	84	55,592.12	35,103.35	191,695.47
Contra Costa	14	21	234,777.25	681,785.07	916,562.35
Del Norte	1	71	431,726.15	112,778.79	544,503.34
"	71	32	35,539.42	15,167.10	50,803.52
El Dorado	11	53	485,252.04	257,770.43	787,032.47
"	23	5	11,560.53	2,581.56	16,572.46
"	38	34	32,419.90	215,477.88	307,897.78
"	55	44	70,362.52	64,752.02	135,114.54
Fresno	4	35	134,721.64	192,515.18	326,413.72
"	10	50	92,834.52	19,325.91	112,496.83
"	41	13	18,691.91	3,089.45	21,781.27
Glenn	7	38	155,376.74	140,088.35	295,394.63
"	45	22	88,740.23	264,453.93	353,194.16
"	47	10	27,345.62	6,913.16	34,274.78
Humboldt	1	143	1,281,448.78	593,862.95	1,875,211.73
"	30	43	131,282.68	27,605.10	158,888.68
"	44	28	58,545.94	520.89	59,457.83
Imperial	12	35	151,527.65	278,736.32	430,555.98
"	24	50	277,556.70	169,211.25	446,896.65
"	27	57	219,155.79	116,241.20	335,405.55
Inyo	23	133	333,228.91	227,779.51	561,008.52
"	53	39	25,941.11	115.77	26,756.88
Kern	4	74	563,742.15	1,407,115.22	2,000,857.41
"	23	73	171,329.15	124,529.08	296,052.23
"	33	99	95,999.00	1,857.33	97,433.33
"	57	122	113,518.23	45,852.35	159,572.92
"	58	31	15,335.15	137.10	15,945.25
Kings	10	31	82,083.74	14,917.55	96,821.29
Lake	15	46	60,032.24	17,502.84	77,535.08
"	16	5	26,251.21	33,231.34	102,722.55
"	45	29	55,579.10	23,257.69	78,776.66
"	50	0	885.05		885.05

County	Route	Miles under Maint.	General Maintenance	Improvement and Reconstruction	Total
Lassen	28	19	$ 37,205.37	$ 470.58	$ 37,675.25
"	29	94	182,990.19	143,007.54	325,997.73
Los Angeles	3	35	349,627.93	2,301,299.27	2,651,227.20
"	4	58	529,841.80	1,085,918.67	1,615,759.67
"	9	28	199,710.13	352,877.47	552,587.60
"	19	1	4,057.50		4,057.50
"	23	54	146,532.03	25,508.35	172,040.38
"	59	36	22,185.71		22,185.71
"	60	42	183,243.37	105,689.67	288,933.04
"	61	4	27,594.31	13,926.86	41,521.17
Madera	4	27	151,969.09	105,340.74	257,309.83
"	32	16	14,745.94	953.98	15,699.92
Marin	1	35	180,851.09	227,454.72	408,305.81
"	5	4	70,444.77	12,142.18	82,586.95
"	52	3	31,967.34	426.30	32,393.64
"	57	5	15,527.27	5,405.83	21,337.10
Mariposa	18	56	224,313.50	280,731.40	505,044.90
"	40	2	6,382.55	4,474.55	10,857.15
Mendocino	1	114	1,057,438.94	796,381.25	1,852,819.89
"	5	13	69,988.30	2,587.47	72,575.77
"	16	10	73,823.25	29,376.93	103,503.18
"	48	40	126,529.30	34,310.80	156,840.10
"	70	2	10,281.07	150.00	10,431.07
Merced	4	35	200,525.25	878,520.15	1,079,445.40
"	18	15	5,525.75	13,157.70	42,803.45
"	32	41	75,751.75	67,304.28	143,056.03
Modoc	28	83	133,680.79	102,257.27	235,938.06
Mono	13	15	7,754.35	4,943.41	12,697.77
"	23	113	227,453.30	159,413.25	386,843.45
"	60	15	55,468.42	17,778.58	73,247.56
"	63	2	71.18		71.18
Monterey	2	97	447,732.15	545,567.62	993,425.77
"	10	28	15,552.43	20,455.49	40,411.62
"	56	49	104,247.02	6,532.40	110,779.42
Napa	8	15	113,580.33	5,816.39	119,396.72
"	45	11	105,215.72	14,464.16	120,280.88
Nevada	15	35	48,485.10	19,600.35	68,085.45
"	17	18	52,782.43	6,837.53	59,619.96
"	25	18	53,907.75	460.68	54,368.43
"	37	34	144,293.01	35,625.91	179,918.92
"	38	19	60,258.88	4,283.30	64,542.18
Orange	2	42	317,517.19	1,269,520.15	1,587,037.34
"	60	25	78,574.03	79,810.43	158,384.46
Placer	3	19	82,165.80	143,282.38	225,448.18
"	17	23	83,515.25	13,382.16	96,897.42
"	25	45	348,032.56	128,703.50	476,736.06
"	38	22	75,445.23	128,145.33	204,590.56
"	39	12	20,372.44	114,589.92	134,962.36
"	65	1	5,755.02	14,259.36	20,014.38

STATE HIGHWAY MAINTENANCE FUND EXPENDITURES—Continued

County	Route	Miles under Maint.	General Maintenance	Improvement and Reconstruction	Total
Shasta	1	72	$ 71,735	$ 2,815,[illegible]	$ 3,[illegible]
"	20	67	785	21,[illegible]	111,[illegible]
"	22	87	3,954	42,[illegible]	245,[illegible]
Sierra	25	17	[illegible]	41,[illegible]	111,[illegible]
"	29	4	[illegible]	181,[illegible]	2,[illegible]
"	35	8	1,[illegible]	[illegible]	1,[illegible]
"	37	13	2,[illegible]	[illegible]	2,[illegible]
"	38	2	[illegible]	[illegible]	[illegible]
Siskiyou	3	74	[illegible]	521,[illegible]	1,091,[illegible]
"	45	145	1,[illegible]	7,[illegible]	185,[illegible]
Solano	7	44	1[illegible]	561,[illegible] 64	[illegible]
"	8	3	[illegible]	10,[illegible] 73	[illegible]
"	43	21	[illegible]	[illegible] 75	53,[illegible] 10
Sonoma	1	56	[illegible] 73	[illegible]	1,15[illegible]
"	8	135	[illegible]	[illegible]	[illegible]
"	51	23	[illegible]	[illegible]	[illegible]
Stanislaus	4	22	1[illegible]	[illegible]	[illegible]
"	13	28	[illegible]	78,[illegible]	1[illegible]
Sutter	3	12	[illegible] 68	[illegible]	[illegible]
"	15	15	[illegible]	141 [illegible]	24,[illegible]
Tehama	3	52	1[illegible]	8[illegible] 238	2[illegible]
"	7	52	[illegible]	27,067.[illegible]	7[illegible]
"	29	55	121,182.01	62,474.53	185,[illegible]
Trinity	20	82	[illegible]	56,144.17	[illegible]
"	35	31	[illegible]	[illegible]	82,[illegible]
Tulare	4	27	2[illegible] 00	[illegible] 17	[illegible]
"	10	35	81,187.49	[illegible]	128,109.[illegible]
Tuolumne	13	50	[illegible] 72	36,[illegible] 37	[illegible]
"	18	5	[illegible]	1,[illegible] 78	[illegible]
"	40	51	[illegible]	101,[illegible]	[illegible]
"	55	9	[illegible]	[illegible]	22,[illegible]
Ventura	2	42	290,[illegible] 13	2,173,0[illegible]	2,463,[illegible]
"	60	20	131,[illegible]	40,803.52	174,714.41
Yolo	6	15	19[illegible]	[illegible]	[illegible]
"	7	54	116,[illegible]	[illegible]	[illegible]
Yuba	3	13	70,305.41	19,889.[illegible]	[illegible]
"	15	21	[illegible]	257 [illegible]	[illegible]
"	25	11	41,295 [illegible]	2,057 [illegible]	[illegible]
Grand Total		1[illegible]	$[illegible]	$[illegible]	$[illegible]

GRAPH SHOWING MILEAGE OF STATE HIGHWAYS UNDER MAINTENANCE BY TYPES, JUNE 30, 1928



MILES	PER CENT	TYPE
17	0.26	BRIDGES
2399	37.66	EARTH
469	7.36	ROCK
1001	15.71	OILED ROCK
367	5.77	BITUMINOUS MACADAM
460	7.22	ASPHALTIC CONCRETE
291	4.57	OILED CONCRETE
1366	21.45	CONCRETE
6370	100.00	TOTAL MILEAGE

EQUIPMENT

R. H. STALNAKER, Equipment Engineer

GENERAL POLICY

The equipment department controls all major or rental equipment of the Division of Highways throughout the state. It is self-supporting, collecting rental for the use of each active rental unit, provides for its retention in service by looking after necessary upkeep and its replacement through providing a depreciation reserve.

EXISTING PROCEDURE

In addition to a well equipped headquarters shop, located at Sacramento, where facilities permit of quickly overhauling or building road making machinery and automobile equipment used by the Division of Highways, this department maintains one or more shops in eight districts, each supplied with a personnel, stock of parts, and facilities best suited for repair requirements most likely to occur in the respective localities.

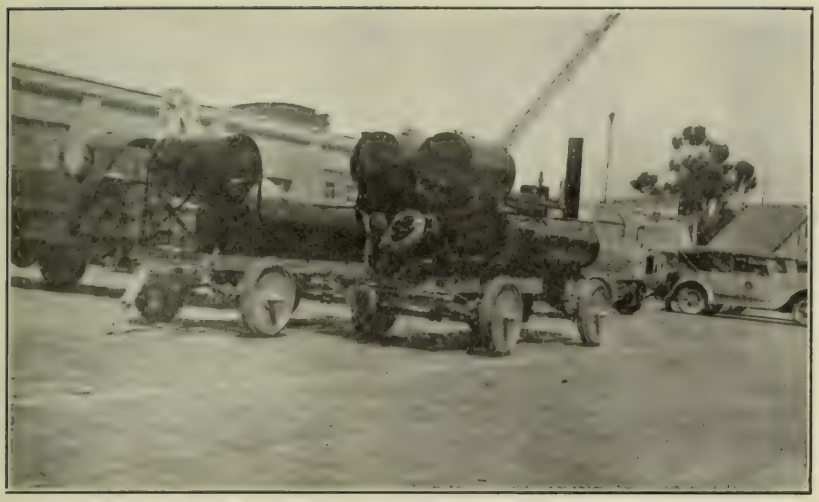
A consolidated statement of operations for the biennium, July 1, 1926, to June 30, 1928, is shown on the following page.

CONSOLIDATED STATEMENT OF OPERATIONS
JUNE 1, 1926, TO JUNE 30, 1928

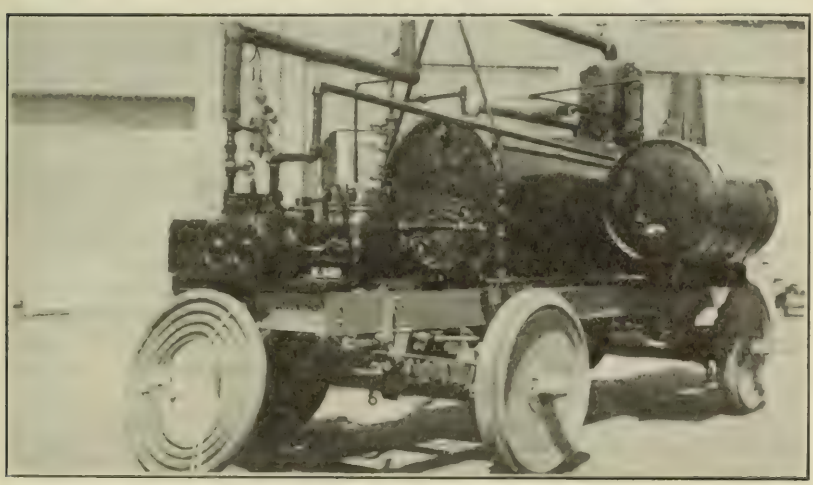
	July 1, 1926, to June 30, 1927		*July 1, 1927, to June 30, 1928*	
Equipment administration—				
Materials and supplies	$12,618 51		$5,222 68	
Service and expense	22,883 51		25,024 13	
Salaries and wages	112,701 53		119,116 08	
Headquarters equipment rental	12,254 32		14,467 74	
Total		$160,457 87		$163,830 63
Equipment upkeep—				
Repair of equipment	$656,413 51		$655,890 80	
Transfer of equipment	21,502 77		25,275 84	
U. S. Government materials	1,928 91*		2,033 79	
Salvage	1,725 13		3,166 76*	
Stores adjustment	11,752 65		25,791 77	
Stores expense	2,403 80		1,485 21	
Shop expense	11,055 60*		1,700 00*	
Equipment research	590 03		1,254 86	
Total		$681,403 38		$706,865 51
Total operating costs		$841,861 25		$870,696 14
Equipment depreciation		700,953 17		639,892 93
Total equipment expense		1,542,814 42		1,510,589 07
Rental and income from other sources		1,640,723 66		1,596,499 91
Net surplus		97,909 24		85,910 84
Reserved for contingencies		19,325 51		28,282 85
Returned to districts		$78,583 73		$57,627 99

* Denotes credit.

The Headquarters Equipment Department staff consists of R. H. Stalnaker, equipment engineer, in general charge of the department's activities; W. J. Gough, assistant highway engineer; J. K. Kinsman and F. W. McManus, assistant equipment engineers; F. L. Richardson,



Portable retort and a steam heating plant, assembled at the Sacramento shops.



Another type of steam heating unit assembled at the Sacramento shops.

senior equipment engineer; Chas. H. Ryon, chief clerk, and F. E. Burnside, shop superintendent.

The directing personnel of the various subdivisions of the department are:

Shop 1—J. W. Grace, superintendent of equipment, Eureka.
Shop 2—J. M. O'Malley, superintendent of equipment, Redding.
Shop 3—D. H. Greeley, junior equipment engineer, Sacramento.
Shop 4—W. A. Smith, superintendent of equipment, San Francisco.
Shop 5—R. P. Hamlin, shop superintendent, San Luis Obispo.
Shop 6—R. J. Carlisle, superintendent of equipment, Fresno.
Shop 7—W. B. Cannon, superintendent of equipment, North Hollywood.
Shop 8—W. D. Cook, superintendent of equipment, San Bernardino.
Shop 9—M. P. Brooks, superintendent of equipment, Bishop.
Shop 10—W. H. Pierce, junior equipment engineer, Sacramento.

These men have charge of the shops in the respective districts and keep in close touch with the district's various activities in an effort to maintain all equipment in an uninterrupted operating condition.

A decrease in number of employees has been brought about during this biennium and an analysis of the situation also shows a decrease in total expenditure for both direct and indirect labor has been possible.

A comparative statement for the two fiscal years included in the period and as shown on their respective consolidated statements is as follows:

	July 1, 1926, to June 30, 1927	*July 1, 1927, to June 30, 1928*	*Decrease*
Direct Labor	$279,513 07	$274,754 18	$4,758 89
Indirect Labor	227,742 09	218,610 16	9,131 93
Total	$507,255 16	$493,364 34	$13,890 82

The above decrease is better indicated in a general decrease of 15.61 per cent in upkeep of equipment during the present biennium as compared with the thirty months immediately preceding it.

RENTAL SYSTEM

The existing rental system, which is gradually being adjusted so as to only care for upkeep, depreciation, and administration for the units in question, has since its inauguration on January 1, 1924, undergone two general, also a number of partial revisions, the last general revision occurring during the current year. The net result of these revisions has brought about a reduction in the rental rates since the last biennium and a total saving to the districts of some $42,000 notwithstanding during the same period the inventory value of used active equipment has been increased more than $75,000.

The following figures are a summarized result of the activities of this service during the two years ending June 30, 1928:

Total rental income	$3,232,476 57
Total operating expense	1,712,557 59
Total net income from rental	1,519,918 98
Reserved for depreciation	1,340,846 10
Accumulated surplus for 78th-79th fiscal years	179,072 88
Refund to Districts from rental surplus	136,211 72
Retained	$42,861 16

The greater part of accumulated surplus accrued mainly because some districts are working under more favorable circumstances than others

and because of the impracticability as well as the unsatisfactory condition which would be the outcome of applying different rates on similar units during their temporary stay in any one district.

That the districts responsible for the surplus would be properly rewarded, it was decided after deductions for contingencies were made from this surplus to return the remainder to them in proportion to accumulations. The amount retained for this contingency fund very nearly approximates 1½ per cent of average inventory values for the seventy-eighth and seventy-ninth fiscal years.

EXPENDITURES FOR NEW EQUIPMENT

The supplying of suitable maintenance and construction equipment and its subsequent upkeep is the principal work of this department, and next to outlays for maintaining and construction of highways, it constitutes the greatest single item of money outlay in the Division of Highways.

The following partial list of active equipment which is now on hand indicates the magnitude of the department's operations:

		Average original cost, each
973	Motor vehicles (240 being of 2-ton cap. or over)	$1,500 00
17	Power shovels	10,000 00
205	Wheel tractors	1,200 00
102	Caterpillar tractors	2,500 00
175	Standard graders	950 00
125	Motor grader attachments for use with tractors	700 00
32	Sacrifiers	500 00
21	Air compressors	2,000 00
44	Gas engines	400 00
41	Pump units	250 00
24	Concrete mixers	600 00
28	Dump cars	110 00
19	Rock crushers	2,500 00
100	Asphalt kettles	350 00

There are also hundreds of other units required in less number.

Considerable equipment entering in the inventory value as of June 30, 1928, and which is shown herein, was constructed at the headquarters shop, such as more than one hundred 1½-yard dump bodies and ten 2½-yard convertible dump bodies for motor trucks, all of special designs best suited for intended use.

Because of road oiling operations undertaken during the past two years, six portable heating and pumping plants, also two portable oil retorts, have been constructed and seven pressure road oilers have been purchased or assembled. Seven asphalt patching plants with desirable features not heretofore found in commercial units, four of which have gas engine-driven air compressors, and a number of power units and combined pumping plants have been assembled at headquarters shop.

On the Redwood Highway, in Mendocino and Humboldt counties, slides are very prevalent, especially during the rainy season in that section, and at times for a thirty-day period have necessitated an expenditure of over $1,100 per day for their removal. As an ample water supply was available throughout this section of state highway, on an approved request of the district engineer, one type of portable pumping plant was assembled to facilitate the slide removal by hydraulicking. The special equipment consisted of a four-inch single stage centrifugal priming pump operated by direct connected 50 hp. gasoline engine and a four-inch multiple stage centrifugal pump driven

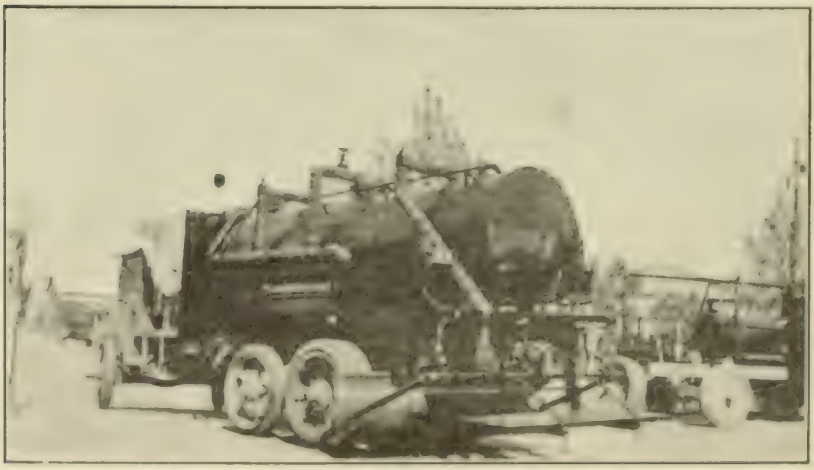
by a heavy duty gasoline engine developing 145 hp. and capable of delivering 400 g.p.m. at 200 pounds pressure.

On July 1, 1927, the beginning of the seventy-ninth fiscal year, a major part of the inventory value of rental equipment in the department consisted of that received from the United States government (excess war equipment). This used equipment was taken into our accounts at an estimated value, the rate of depreciation being established on a basis of replacement value for new equipment. Most of it was nearing the end of its usefulness, requiring a constantly increasing cost for upkeep. The expenditures for new equipment, consequently, during the biennium exceeded the amount collected in depreciation during that period; however, the resulting decrease in costs for upkeep and more satisfactory working conditions brought about through such outlays have proven it more than warranted.

The total expenditure for new equipment during the biennium was $1,786,190.32 and adding the inventory value of units purchased prior to July 1, 1926, or $1,548,636.13, gives a total of $3,334,826.45 or $523 per mile of road under maintenance as of July 1, 1927.

On July 1, 1928, the depreciated value of active rental equipment acquired from the United States government had shrunk to less than $127,000 and will probably entirely disappear within the coming biennium, whereas the value of similar purchased equipment during the two fiscal years, both active and inactive, owned by the Division of Highways had increased to nearly $2,700,000; the recorded status of these features are as follows:

Total inventory value of all rental equipment on July 1, 1926		$3,259,650 16
Corrections and adjustments necessary July 1, 1926, to June 30, 1928		215,223 48
Inventory value of equipment as of July 1, 1926		3,044,426 68
Less inventory value of equipment retired July 1, 1926, to June 30, 1928		1,495,790 55
Remaining inventory value of equipment acquired prior to July 1, 1926		1,548,636 13
Inventory value of equipment purchased July 1, 1926, to June 30, 1928		1,786,190 32
Value of active and inactive equipment as shown by 79th fiscal year statement		$3,334,826 45



One thousand-gallon pressure oil spreader assembled at the Sacramento shops.

DISPOSAL OF OBSOLETE EQUIPMENT

Owing to the prevalence of much excess war equipment, all in a somewhat similar condition, that had been distributed to every state by the United States government for road building purposes, its clearance has been slow. In its disposal, markets both direct and indirect which are far removed from this state have been secured.

It has been possible to get prices somewhat higher than that paid for junk by requesting bidders contemplating selling the Division of Highways new equipment to examine it beforehand and state what they would allow on obsolete, but still usable units, which might be taken in for part payment. Through the hearty cooperation and prompt action of the Division of Service and Supply, of the State Department of Finance, and a constant endeavor to at all times secure a reasonable price for this obsolete equipment, the final result of the operations of the biennium shows a loss of less than six-tenths of one per cent on its inventory value, the amount realized being within 96 per cent of its book value at time of sale.

The entire situation is set forth by the following figures for seventy-eighth and seventy-ninth fiscal years:

Inventory value of equipment disposed of		$1,495,790 55
Total depreciation charged off during its life		1,288,681 91
Book value remaining at time of sale		207,108 64
Received from sale of equipment from July 1, 1926, to June 30, 1928		199,363 87
Loss from sale of obsolete rental equipment		$7,744 77

SHOPS

With the completion of shops at North Hollywood (District VII) and Bishop (District IX) during the past biennium, eight of the ten districts of the Division of Highways have been furnished with one or more modern repair shops. Two of the districts with main offices in Sacramento have their necessary repair work done at headquarters shop.



High-angle hydraulic lift dump body assembled at the Sacramento shops.

Owing to the extensive operations in District V, the equipment department shop located at San Luis Obispo and which is now housed in an old building, has become too small. Plans for a new plant to be situated at a more convenient location on land purchased for the purpose, have been drawn up and a contract let for its erection.

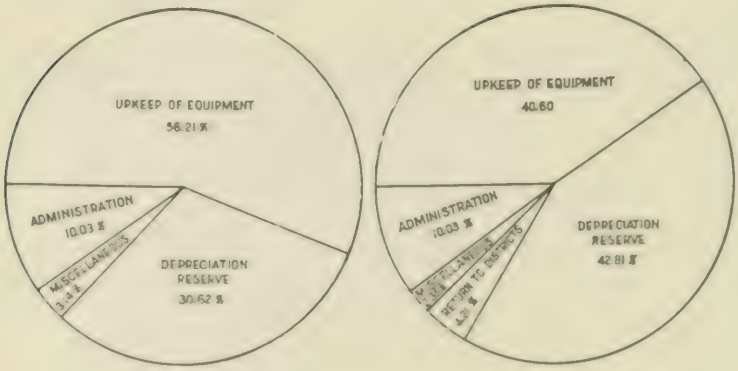
In District I, the district engineer's office having been moved from Willits to Eureka, the equipment department's district administration and shop personnel was also transferred to Eureka where a small shop with limited repair facilities was already located. Consideration is now being given to supplying facilities at the new location to meet changed conditions.

The district shops are almost entirely devoted to and are situated with a view to efficiently caring for repairs only. At the headquarters shop located in Sacramento, both repairs and construction work is readily handled, and also unusual repairs to equipment that cannot be handled at any of the other district shops, the extent of which warrants the expense of sending to Sacramento.

GENERAL SUMMARY

A decrease of 15.61 per cent in the upkeep of equipment was made possible because of more efficient repairing methods brought about, also the new units secured required less outlay for upkeep than those they replaced. These same conditions also account for permitting a greater part of our revenue to go into the depreciation reserve over that set aside during the previous biennium, notwithstanding, during the present period, a large reduction was made in rental rates of equipment most generally used.

The following diagram graphically indicates a general improvement in operations of this department during the biennium as compared with the preceding thirty months.



JAN. 1, 1924 TO JUNE 30, 1926
30 MONTHS

JULY 1, 1926 TO JUNE 30, 1928
24 MONTHS

DISTRIBUTION OF EQUIPMENT DEPARTMENT REVENUES

RIGHTS OF WAY POLICIES AND PROBLEMS

By C. C. Carleton, Chief, Division of Contracts and Rights of Way

THE TREMENDOUS increase in motor transportation has necessitated the building of highways of greater capacity, with better and safer alignment and of higher standards of construction, not only to serve the very pressing needs of the present, but to provide for further development and expansion in the future. To keep pace with this remarkable growth, rights of way have become of paramount importance.

A great portion of California's highway system, as originally adopted, utilized the existing rights of way of old county roads with widths varying from 40 feet upwards, with an average of 60 feet, and much of it on alignment not at all commensurate with modern standards. These widths have been found to be wholly inadequate to accommodate the streams of traffic which pour over our roads.

PRESENT POLICIES

The legislature in 1927 amending section 2620 of the Political Code provided, "the width of all state highways or all roads, avenues or ways under the control or supervision of the California Highway Commission, shall be at least 80 feet." It is now the definite policy of the Department of Public Works, that on all main north and south state highways and on all other important arteries of travel the minimum width shall be 100 feet.

PROGRESS TOWARD NEW STANDARDS

During the present biennium great progress has been made in securing these minimum requirements, notable examples being the Foothill Boulevard in Los Angeles and San Bernardino counties, which was widened from 60 to 100 feet, and the Bay Shore Highway in San Mateo County, which was widened to 120 feet. A comprehensive effort is being made to secure wider and more adequate rights of way on all roads on the state highway system. On practically every road which was built or reconstructed during the present fiscal year the ultimate width was obtained *before* the contracts were let.

WORK COVERS WIDE FIELD

During the last half of this biennium negotiations with upward of 2500 property owners, involving literally thousands of parcels of land for rights of way, have been consummated.

Realizing the impetus given to property values by the construction of fine highways, many owners have generously donated their lands, and this splendid cooperation accorded the state is attested to by the fact that it has been found necessary to resort to condemnation in less than 3 per cent of the cases handled during this period, and in many instances court action was had because of legal technicalities involving flaws in titles.

NEW DIVISION IS ORGANIZED

Within the last year there was created and organized the Division of Contracts and Rights of Way of the Department of Public Works one of whose functions is to coordinate the right of way activities of the Division of Highways and assist and advise on the myriad of prob-

lems both legal and practical which present themselves. A simple but comprehensive system of keeping a record of right of way transactions has been established.

There are one or more right of way agents attached to each of the ten highway districts of the state, regularly engaged in the solicitation and acquisition of rights of way.

Mr. Harry McClelland, attorney-at-law, headquarters right of way agent at Sacramento, keeps in personal touch with the general state wide operations and maintains the records thereof, and Mr. George Geiger, chief right of way agent at San Francisco, devotes his time to the settlement of right of way situations which have failed of amicable adjustment in the field and have reached the courts in condemnation proceedings.

While the state has received the utmost cooperation from the various counties, the department has assumed the primary responsibility of securing rights of way for state highways.

ATTENTION GIVEN TO SCENIC SPOTS

The department is endeavoring to anticipate the needs of the future and not the least of its activities has been the securing of beauty spots contiguous to the highways and thereby protecting them forever for the enjoyment of the motoring public. Many parcels of land offering rare scenic charm both in the mountains and along the seashore have been added to the highway system of the state.

NEW POLICIES UNDER CONSIDERATION

The boards of supervisors throughout the state have continued to cooperate with the department in submitting for its approval maps of projected subdivisions, thus affording the opportunity for widening and improvement of state highways, prior to the actual laying out of the same. Studies are being made, however, as to the advisability of requesting the action of the legislature, making it compulsory to submit all plans of subdivisions abutting on the state highway system to the Department of Public Works for its approval.

Another matter which is receiving the serious attention of the department is the question of zoning and set-back legislation permitting greater expansion of state highways and prohibiting encroachments of an unsightly nature.

The following table showing expenditures for rights of way on the state highway system since its inception clearly demonstrates the mounting importance of adequate rights of way:

COST OF RIGHT OF WAY

District	Jan. 1, 1924 June 30, 1926	78th F. Y. July 1, 1926 June 30, 1927	79th F. Y. July 1, 1927 June 30, 1928	78th and 79th Fiscal years	Totals to June 30, 1928
I.	$17,048 61	$16,189 22	$15,855 86	$32,045 08	$49,093 69
II.	12,994 13	7,372 61	44,058 25	51,430 86	64,424 99
III.	24,011 25	40,867 69	70,309 62	111,177 31	135,188 56
IV.	17,976 22	118,359 49	100,606 05	218,965 54	236,941 76
V.	73,590 28	85,173 23	55,583 86	140,757 09	214,347 37
VI.	7,920 36	8,376 54	25,904 18	34,280 72	42,201 08
VII.	76,926 41	93,209 94	88,343 52	181,553 46	258,479 87
VIII.	7,638 52	3,633 64	12,059 15	15,692 79	23,331 31
IX.		53 03	3,415 70	3,468 73	3,468 73
X.	6,514 75	13,915 57	35,670 02	49,585 59	56,100 34
Total	$244,620 53	$387,150 96	$451,806 21	$838,957 17	$1,083,577 70

Charges for right of way previous to January 1, 1924, were very small and were included under construction charges. Up to that time the counties furnished all rights of way and since then have furnished considerable.

REPORT OF THE ATTORNEY FOR THE DIVISION OF HIGHWAYS

By Harry A. Encell, Attorney.

The work of the attorney for the Division of Highways has shown a large increase in volume during the biennium covered by this report. This has been due chiefly to the increasing number of right of way matters coming before the office, which in its turn reflects the increased activity in state highway construction. It is safe to say that at the present time fully one-third of the time of the attorney is taken up by matters involving the settlement or the trial of condemnation suits for right of ways. Each case whether settled out of court or tried in court, involves a detailed examination of title, deeds, etc.

Other duties of the attorney have to do with the examination of title reports; the approval of contracts, service agreements and claims; the presentation of grade separation cases to the Railroad Commission; the defense of civil suits in which the Division of Highways becomes involved from time to time.

The work of the attorney has been under the general supervision of C. C. Carleton, chief of the Division of Contracts and Right of Ways, State Department of Public Works, and the activities of these two offices are closely coordinated.

A recapitulation of condemnation suits filed during the biennium shows the following totals:

Recapitulation

Total number of suits involved in this report	76
Total number of parcels involved	522
Total number of defendants involved	1,198
Total number of suits settled	30
Total number of parcels settled	331
Total number of defendants involved in settlement	825
Total number of suits pending	46
Total number of parcels pending	191
Total number of defendants pending	373

The list of such suits follows:

Status of Condemnation Suits as of November 1, 1928

People versus	*County, route and section*	*Parcels involved*	*Parcels pending*
Sand Bar Club et al.	I-Hum-1-G	1	Settled
Francisco Realty Corporation et al.	II-Sis-3-A	19	1
Adele Basler et al.	II-Sha-3-D	4	2
Carrie Williams et al.	II-Sha-3-D	1	Settled
Alice Miller Bradford et al.	II-Sha-3-D	3	Settled
Frank P. Childs et al.	II-Teh-29-C	7	7
George W. Olsen et al.	II-Plu-29-A	4	4
Milos Mitrov Gopcevic et al.	III-Lak-15-B	2	Settled
Mike Pilafan et al.	III-Sac-3-B	1	Settled
Carson-Tahoe Lumber & Fluming Co. et al.	III-Pla-3-A	2	Settled
Carson-Tahoe Lumber & Fluming Co. et al.	III-Pla-38-A	3	2
Truckee River General Electric Co. et al.	III-Pla-38-A	4	Settled
Elmer S. Colwell et al.	III-Pla-38-A	1	1
Ruby B. Viney et al.	III-Col-7-A	1	Settled
Ollie M. Hansen et al.	III-Lak-15-C	1	Settled
Gold Run Ditch and Mining Co. et al.	III-Nev 37-A	1	1
Gold Run Ditch and Mining Co. et al.	III-Pla-37-F	1	1
Mary L. Dwyer et al.	III-Gle-7-C	1	Settled
William Martin et al.	III-ED-11-I	1	1
Milos Mitrow Gopcevic et al.	III-Lak-15-B	1	1
Alden J. Steele et al.	III-Pla-37-A	2	2
Charles A. Gettys et al.	III-Lak-15-B	2	2
William Dreher et al.	III-ED-11-I	1	1

People versus	County, route and section	Parcels involved	Parcels pending
Emilie Flager et al.	IV-SM-68-B	2	Settled
Charles R. Potter et al.	IV-Son-8-B	1	Settled
Eliza Gagliardo et al.	IV-Son-1-B	15	1
Andrew Fragari et al.	IV-Son-1-A	1	Settled
William Siebe et al.	IV-Mrn-69-A	2	2
Austin G. Abers et al.	IV-Son-1-B	26	8
Manuel Azevedo et al.	IV-CC-14-B	10	4
David Arata et al.	IV-SM-2-A	33	2
Julia Bodkin et al.	IV-Mrn-1-A	3	3
Ida Sargent Baxter et al.	IV-SC1-2-C	1	1
William Ballhaus et al.	IV-SM-68-A	1	Settled
John Carey et al.	IV-Son-1-C	3	1
Harry E. Solen et al.	IV-Son-8-A	1	Settled
B. C. Lauston et al.	IV-Mrn-52-A	1	1
Walter Douglas et al.	V-SB-2-J	2	Settled
Lettie P. Abbott et al.	V-SB-2-J	87	2
Angeline J. Fast et al.	V-SB-2-K	1	Settled
Margaret K. Andrews et al.	V-SB-2-H&J	23	Settled
Rosa Machado et al.	V-SLO-2-E	1	Settled
Dena Asmussen et al.	V-SLO-2-E&D	4	4
Cross Lumber Company et al.	VI-Mer-4-A	3	Settled
Fresno Rock Products Company et al.	VI-Mad-4-A	1	Settled
Aaron J. Heitzig et al.	VI-Tul-4-F	7	7
R. J. Bowers et al.	VI-Ker.-57-E	1	1
Title Insurance & Trust Company et al.	VII-LA-60-B	1	Settled
Thomas R. Bard et al.	VII-Ven-60-A	7	Settled
Hickey Brothers et al.	VII-Ven-2-F	1	1
G. W. Lindsey et al.	VII-SD-12-A	1	Settled
Marblehead Land Co. et al.	VII-LA-60-A&B	5	5
Marblehead Land Co. et al.	VII-LA-60-A	1	1
A. L. Hobson et al.	VII-Ven-2-F	1	Settled
Thornhill Broome et al.	VII-Ven-60-A	1	1
Christine E. Groome et al.	VII-SD-12-D	2	1
Edith L. Pratt et al.	VII-LA-9-I	1	1
Frank L. Powell et al.	VII-SD-12-D	1	1
C. H. McWilliams et al.	VII-LA-4-E	1	1
Thornhill Francis Broome et al.	VII-Ven-60-A	2	Settled
Thornhill Francis Broome et al.	VII-Ven-60-A	4	Settled
Arthur W. Spencer et al.	VIII-Riv-26-F	5	1
Sydney B. Brown et al.	VIII-Riv-64-D	16	16
Bernardine Bedford et al.	VIII-SBd-43-A	1	1
R. M. Chapman et al.	VIII-Imp-26-BCD	59	16
Sarah W. Swim et al.	VIII-Riv-64-C&D	69	39
Dix S. VanDyke et al.	VIII-SBd-58-F&G	32	32
Thomas O'Connor et al.	IX-Yol-6-C	2	Settled
Paolo Sanguinetti et al.	X-SJ-4-C	1	1
Helen C. Ayres et al.	X-Sac-4-A	5	3
J. W. Angrave et al.	X-Sac-4-A	1	1
Jessie M. Stephens et al.	X-Sac-4-A	1	Settled
Daniel Madigan et al.	X-Sol-8-A	2	2
Hattie A. Cluck et al.	X-SJ-66-A	1	1
Hartwell Laurence et al.	X-SJ-66-A	1	Settled
David Sanguinetti et al.	X-Tuo-13-C	3	3

These matters, from the time and passage of the resolution of condemnation by the California Highway Commission, are handled under the direction and supervision of Mr. George Geiger, chief right of way agent for the attorney for the Division of Highways.

The following applications for the construction of overhead crossings and subways have been filed and heard before the Railroad Commission of the state:

Applications to Railroad Commission for Orders

Authorizing construction of two overhead crossings east of Auburn, Placer County—III-Pla-37-A.

Authorizing construction of subway under tracks of Southern Pacific Company, at Brighton, Sacramento County—III-Sac-11-B.

Authorizing construction of overhead crossing of tracks of Southern Pacific Company, at Magra, Placer County—III-Pla-37-C.

Authorizing following construction: Subway near Truckee, Nevada County; overhead crossing of tracks of Southern Pacific Company about five miles north of Tahoe City; grade crossing of Southern Pacific Railroad at Tahoe City, Placer County, and abandonment of nine existing grade crossings between Truckee and Tahoe City—III-Pla-37-A.

Authorizing construction of overhead crossing at Benham, Santa Barbara County, over tracks of Southern Pacific Railroad—V-S.B-2-H.

Authorizing construction of overhead crossing of tracks of Atchison, Topeka & Santa Fe Railway, near Galavan, Orange County—VII-Ora-2-B.

Authorizing construction of overhead crossing of tracks of Atchison, Topeka & Santa Fe Railway, at Irvine, Orange County—VII-Ora-2-B.

Authorizing construction of grade crossings over tracks of Pacific Electric Railway, near San Dimas, Los Angeles County—VII-L.A-9-1

Authorizing construction of overhead crossing of Southern Pacific Company near Saugus, Los Angeles County—VII-L.A-4-A.

Authorizing construction of two subways under tracks of Atchison, Topeka, & Santa Fe Railway, at Serra, Orange County—VII-Ora-60-C.

Authorizing closing of existing crossing at Victoria street, Serra, Orange County—VII-Ora-60-C.

Authorizing construction of subway under tracks of Southern Pacific Company at Araz Junction, Imperial County—VIII-Imp-27-B.

Authorizing construction of overhead crossing of tracks of Los Angeles & Salt Lake Railroad, near Wineville, Riverside County—VIII-Riv-11-A.

Authorizing construction of grade crossing of tracks of Southern Pacific Company, near Owenyo, Inyo County—IX-Iny-23-J.

Authorizing construction of grade crossing of tracks of Southern Pacific Company, near Owenyo, Inyo County—IX-Iny-23-H.

Authorizing construction of grade crossing of tracks of Southern Pacific Company between Olancha and Cottonwood Creek, Inyo County—IX-Iny-23-J.

Authorizing realignment of highway tracks at grade over tracks of Southern Pacific Company, north of Galt, Sacramento County—X-Sac-4-A.

Authorizing construction of subway under tracks of Southern Pacific Company near Helisima, Calaveras County—X-Cal-24-A.

Authorizing construction of subway under tracks of the Southern Pacific Company at Mossdale, San Joaquin County—X-S.J-5-B.

Authorizing construction of grade crossing of tracks of Central California Traction Company, north of Stockton—X-S.J-4-C.

In addition to the foregoing the Highway Commission has participated in the following applications before the Railroad Commission presented by agencies outside of the Division.

Application of Outside Agencies to Railroad Commission

Investigation on motion of Railroad Commission of the State of California as to safety of grade crossings at Barstow, San Bernardino County, Road VIII-S.Bd-58-D.

Application of Southern Pacific Company for order authorizing construction of grade crossing of a side track across state highway in the vicinity of Modesto, Stanislaus County.

Application of Board of Supervisors of County of Santa Clara for permission to construct Martinvale Road, across right of way of Southern Pacific Company and state.

Application of Oakdale Irrigation District, South San Joaquin Irrigation District, etc., for permission to construct permanent grade crossing over state highway.

Application of Southern Pacific Company for order authorizing construction at grade and at separated grades of railroad tracks across certain streets, and highways, and across the track of the Western Pacific Railroad in the City of San Jose, and in the vicinity of San Jose, County of Santa Clara.

The following civil actions have been taken care of, or are now being handled by the attorney:

Civil Cases

H. P. Bowers vs. *Ralph W. Bull et al.*, Mendocino County. Application for restraining order directed against the Highway Commission and its employees.

Carolyn Chilberg vs. *State of California et al.*, Los Angeles County. Complaint for damages to property.

The First National Bank of Eureka vs. *The State of California*, Humboldt County. In re Contract 654-D, Englehart Paving Company. Jupdgment for plaintiff.

D. A. Foley & Company, a corporation vs. *The State of California.* Complaint for money, in re Contract 448—City and County of San Francisco.

H. E. Hadley vs. *Kaiser Paving Company*, Alameda County. Suit on contract for sum of $316.20. Case dismissed as to defendant Department of Public Works on June 14, 1928.

William Meagor vs. *John W. McDonald et al.*, City and County of San Francisco. Complaint for money on contract, Division IV-Marin-1-B.

Rolandi vs. *State of California*, City and County of San Francisco. Claim on Contract 443 for constructing Klamath River Bridge, I-D.N-1-A.

John H. Ross vs. *County of Stanislaus et al.*, Stanislaus County. Suit to determine title of land.

William H. Rykert vs. *Department of Public Works et al.*, Mariposa County. Claim for damages to property. On motion of plaintiff case dropped from calendar to be restored at motion of either party.

Winslow vs. *Ralph Bull et al.*, Sacramento County. On appeal, respondents reply brief filed.

Henry Gianelli vs. *F. W. Haselwood et al.*, Butte County. Complaint for damages to property. Case was tried at Oroville on June 26, 1928, decision in favor of defendant.

Department of Public Works vs. *George H. Bonville*, Shasta County. Complaint for injunction restraining defendant from interfering with construction of highway. Injunction granted.

D. L. Morrison vs. *George M. Souter, California Highway Commission et al.* Complaint for money on Contract 491, Schmidt & Hitchcock, Contractors, Souter subcontractor. Settled.

Hammond Lumber Company, a corporation vs. *E. L. Coon, etc.*, Los Angeles. California Highway Commission defendant and cross-defendant in suit in re money on Contract M-111. Settled.

F. S. Hansen and L. J. Wright vs. *State of California et al.*, Los Angeles. Suit arising from Contract 491, Schmidt & Hitchcock. Settled.

Norman B. Conway, petitioner vs. *Ralph W. Bull et al.*, Imperial County. Peremptory Writ of Mandamus in re Contract No. 478. Claim paid.

Orange County Rock Company vs. *Norman B. Conway, California Highway Commission, etc.* Petition for Writ of Mandate in relation to Contract No. 478.

John Swetkovich vs. *California Highway Commission*, San Bernardino County. Claim on Contract M.W.O. 3000-63. Settled for $445.45.

James M. O'Hara vs. *People of the State of California*, Contra Costa County. Suit arising from condemnation proceeding of *People* vs. *Manuel Azevedo et al.*, particularly as to defendant Thomas R. Hanna.

John W. Stemmle vs. *The American Toll Bridge Company et al.* Complaint for trespass and damage arising from contract with Tieslau Brothers, and condemnation of land owned by Thomas R. Hanna. Settled.

Thomas R. Hanna vs. *August Tieslau, John H. Skeggs et al.* Complaint for trespass and damage arising from contract with Tieslau Brothers and condemnation of land owned by Thomas R. Hanna.

Application of Emma Rose for the exclusion of certain lands in San Mateo County. Dismissed August 25, 1927.

Protest of the Draymen's Association of Alameda County against enforcement of Ordinance No. 189, County of Contra Costa, as to weight of vehicles. Protest refused.

Some of the most important of these cases are the result of controversies, which arose during the incumbency of the former California Highway Commission under the preceding state administration, but which are now being defended by the present State Highway authorities, in order that the actual merits of the claims may finally be determined by the courts. Among these are several suits involving large amounts of money.

1. *Rolandi* vs. *State of California.*

This is an action by the contractor, who constructed the Douglas Memorial Bridge over the Klamath River at Requa, against the State of California, for alleged damages in the sum of $336,273.22.

2. *D. A. Foley & Company* vs. *State of California.*

An action against the State of California for recovery of the sum of $100,000, for alleged damages, arising out of a state highway contract in San Mateo County.

3. *William H. Rykert* vs. *State of California.*

An action for alleged damages, to the amount of $111,635, arising out of the location of a convict camp and a state highway near Briceburg, in the Merced Canyon, Mariposa County, on certain alleged mineral claims of the plaintiff.

HOW POWERS OVER STATE HIGHWAYS ARE DISTRIBUTED UNDER NEW PLAN OF REORGANIZED STATE GOVERNMENT

ALL POWERS AND DUTIES formerly granted to or imposed upon the California Highway Commission, except those enumerated below, have been transferred to the Department of Public Works and are exercised through the Division of Highways.

DUTIES OF CALIFORNIA HIGHWAY COMMISSION

The duties retained by the California Highway Commission are briefly as follows:

The power to alter or change the route of any state highway and to abandon any portion thereof, when in the opinion of the Commission such alteration, change or abandonment shall be necessary or advisable; the power to abandon any lands or parts thereof which have been taken or acquired by the state for highway rights of way; the power to designate the fund or funds for the construction of highways into which federal aid money shall be placed; except as may be otherwise provided by law, the power to select, adopt and determine the routes for new state roads and highways and to allocate moneys for the construction or repair of the various roads and highways under the jurisdiction of the Department of Public Works and to determine in each case the maximum sum of money that shall be made available therefor and to conduct preliminary surveys for the determination of the advisability of including in or excluding from the state highway system any road, or portion thereof (provided that not more than one-half of the cost of any such preliminary survey shall be paid from state funds available for such purposes); the Department of Public Works may not take property by eminent domain until the California Highway Commission shall have passed a resolution declaring the public interest and necessity require such acquisition.

DUTIES OF DIVISION OF HIGHWAYS

The powers and duties of the Division of Highways may be summarized as follows:

1. To take and have full possession and control of all roads and highways which have been declared and adopted state roads and state highways and all state roads and state highways which may hereafter be acquired or constructed.

2. To acquire rights of way, subject in case of eminent domain to the authorization of the California Highway Commission.

3. To maintain all traversable roads which now are or that may be hereafter included in the state highway system.

4. To do any and all things necessary or proper for the erection, construction, maintenance, management and control of all roads, highways, and other properties which are now or hereafter may be placed under its control, including the construction and maintenance of detour roads, and subject to the Department of Finance, the purchasing, leasing, renting or otherwise obtaining all tools, implements and supplies which it shall deem necessary or proper for the performance of the duties imposed upon it by law. (Political Code 365*d*.)

5. To cause to be prepared and to approve all plans and specifications for all work done under its direction.

6. To determine the kind, quality and extent of such work.

7. To direct whether any such work shall be done by contract, in whole or in part, or by day labor in whole or in part, and, after the approval of the plans, specifications and estimates, if, in its opinion the acceptance of any bid or bids shall not be for the best interests of the state, or if, in its opinion the acceptance of any further bids, after the rejection of all bids submitted, shall not be for the best interests of the state, the division may direct that the work or improvement be done upon a day labor basis.

8. The full control of such day labor work is placed under the Department of Public Works and the department or a division may do all things necessary to properly carry out the work.

9. To let any subdivision or unit of said day labor work by contract upon informal bids.

10. When it appears from the plans, specifications and estimates of cost that the cost and expense of doing any construction, reconstruction, alteration, maintenance, repair or other work authorized to be done by or under the direction of the department, will not exceed fifteen thousand dollars, the director may direct that said work be done under contract awarded to the lowest possible bidder or bidders upon public notice. (Political Code 365c.)

11. In the name of the people of the State of California, to condemn, subject to the approval of the California Highway Commission, or to purchase or receive by donation or dedication or lease any right of way, rock quarry, gravel pit, sand or earth borrow pit, land necessary or proper for offices, shops, storage yards, lands adjoining or near such highways for parks, and also lands and trees within three hundred feet on each side of the center line of any state road or state highway for culture and support of trees, when in the judgment of said commission the acquisition of said lands and trees, or either, shall be for the benefit of a state highway in aiding in the maintenance and preservation of the roadbed thereof, or aid in the maintenance of the attractiveness or the scenic beauties thereof, and likewise acquire lands for the construction and maintenance of drainage ditches in connection with the highways, also all other lands which said commission shall deem necessary for the construction, use or maintenance of state highways.

12. To acquire, construct and maintain stock trails, paralleling and adjoining or near any state highway in such portions of the state as said commission shall deem necessary or proper. (Political Code 365*f*.)

13. To make such investigations as will put at the service of the state the most approved methods of highway improvement.

14. To compile statistics relative to the public highways of counties and municipalities.

15. To cause to be prepared plans, specifications and estimates for the repair and improvement of highways and bridges, also act as the consulting engineer for any county, road or boulevard district or division, or municipal authorities, when requested.

16. To investigate and determine various methods of road construction adapted to different sections of the state, as to the best methods of construction and maintenance of highways and bridges and to make such experiments relative thereto as deemed expedient.

17. To call upon any state, county or municipal official to furnish any information contained in his office which relates to, or is in any way necessary to the proper performance of the work of said division.

18. To obtain and pay for insurance protecting said commission and individual members thereof, the state highway engineer and the various assistants and employees of said commission and engineer, all while on state business, against loss or damage because of injury to person or property of others by said insured while driving any truck or automobile and to pay the premium on such insurance.

19. To prepare biennial reports relating to road and highway work which are submitted to Governor thirty days before each session of the legislature. (Political Code 365*h*.)

20. To have jurisdiction of cooperative highway work to be engaged or existing in by the state with the United States government, subject to the authority of the California Highway Commission to allot funds. All plans, estimates and specifications of road work shall be approved by the commission and said commission shall have full powers to determine the kind, quality and extent of such work. (Political Code 365*i*.)

GASOLINE TAXATION AND CLASSIFICATION OF STATE HIGHWAYS

By C. C. CARLETON, Chief, Division of Contracts and Rights of Way, Department of Public Works

ORIGINAL TWO-CENT GASOLINE TAX

The original gasoline tax act of 1923 (chapter 267, Statutes 1923, amended chapter 359, Statutes of 1925; chapter 716, Statutes 1927) provides for a two-cent license tax for each gallon of motor vehicle fuel sold for use by motor vehicles in the State of California. This measure provides for a refund of the tax where the motor vehicle fuel is used for purposes other than in motor vehicles.

THE MOTOR VEHICLE FUEL FUND

A "motor vehicle fuel fund" is created.

One half of the moneys accruing from the two-cent tax remaining in this fund, after the refunds hereinbefore mentioned have been paid, is distributed among the counties of the state.

The other half accruing from the two-cent tax is paid into the "State Highway Maintenance Fund."

NEW LEGISLATION BY 1927 LEGISLATURE

In 1927, realizing that moneys provided by bond issues for the construction of State highways had become exhausted, Senator Arthur H. Breed of Alameda County, the author of the original gasoline tax of 1923, introduced two measures in the 1927 legislature of California, which were duly passed by the legislature and which inaugurated in this state a new era of State highway building on a "pay as you go" basis and with adequate funds in sight for a complete, coordinated and comprehensive plan of operations covering a period of years.

ADDITIONAL ONE-CENT GASOLINE TAX

The first measure was an act (chapter 795, Statutes 1927) providing for an *additional one-cent gasoline tax to be used exclusively for the construction of state highways.*

This new tax had no effect whatsoever on the previously existing two-cent tax, half of which goes to the counties and the other half to the state for maintenance and reconstruction work.

Thus California joins the list of states having a three-cent motor vehicle fuel tax for highway purposes.

CLASSIFICATION OF STATE HIGHWAYS LAW

But the outstanding measure passed by the 1927 legislature is known as the "Classification of State Highways Law," and also the "Breed Allocation Act." (Chapter 794, Statutes 1927.)

This has provided for the distribution of the state's share of the receipts from the motor vehicle fuel tax acts in an equitable manner between the northern and southern sections of the state.

PRIMARY AND SECONDARY HIGHWAYS

The provisions of this measure divide the state highway system into two classes, primary and secondary.

The primary roads include the main trunk lines, interstate connections, county seat laterals and the roads into the Yosemite and Sequoia National Parks (specifically described in the act).

All other state roads are included in the secondary class.

Seventy-five per cent of the gas tax collected in the additional one-cent levy goes to the primary roads, and twenty-five per cent to the secondary roads.

TWO GROUPS OF COUNTIES

The State is divided into two groups of counties for allocation purposes.

Group No. 1. All of those counties of the State called the northern counties, forty-five in number, not included in group 2.

Group No. 2. San Diego, Imperial, Orange, Riverside, Los Angeles, San Bernardino, Ventura, Santa Barbara, Kern, San Luis Obispo, Tulare, Mono, Inyo. (Called the southern counties and 13 in number.)

Another split is made of respective percentages of the gas money to be received by these two groups, northern and southern.

PRIMARY HIGHWAY DIVISION OF MONEYS

On primary highways each group receives the proportion of the money that the number of miles of primary highways within its own limits bears to the total number of miles of primary state highways designated by law.

The total mileage of primary state highways designated in the Breed Law is 4,287.1 miles.

In the forty-five northern counties there are 2,345.7 miles thereof, or a proportion of 54.7 per cent.

In the thirteen southern counties there are 1,941.4 miles thereof, or a proportion of 45.3 per cent.

Therefore, the northern group is entitled to 54.7 per cent of the primary road moneys and the southern group 45.3 per cent of such moneys.

SECONDARY HIGHWAY DIVISION OF MONEYS

On secondary highways the law provides that the moneys shall be divided equally between the two groups, each receiving 50 per cent of the funds.

ALLOCATION OF MAINTENANCE AND RECONSTRUCTION MONEYS

The Breed Allocation Act also applies by reference to the original gasoline tax act providing for the two-cent tax, one cent of which is used for the maintenance and reconstruction of state highways.

The following provision is self-explanatory:

> All money now or hereafter available under any law of this state for the maintenance, repair, widening, resurfacing or reconstruction of state highways shall be allocated and expended as follows: The California highway commis-

sion is hereby authorized and directed to expend of all said money available each year such proportion thereof as it determines is necessary for general administration expenses and for maintaining or repairing to standard all traversable state highways. All the rest and remainder of said funds available each year shall be expended by the California highway commission for the widening, resurfacing or reconstruction of state highways and the annual expenditures for the last enumerated purposes shall be made within each group of counties enumerated in section 4 hereof in amounts which shall bear the same proportion to the total amount so available during the current year as the number of miles of primary state highways designated in this act within each group bears to the total number of miles of primary state highways herein designated.

EXPLANATORY TABULATION

The following tabulation may clarify the foregoing explanation:

	Primary state highways receive 75% of funds		*Secondary state highways receive 25% of funds*	
	Mileage	*Proportion of funds*	*Mileage*	*Proportion of funds*
45 northern counties	2,345.7	54.7%	1,777.6	50 %
13 southern counties	1,941.4	45.3%	525.2	50 %
Totals	4,287.1	100.0%	2,302.8	100.0%

JOINT HIGHWAY DISTRICT AID

It may be added that out of the secondary state highway construction money *not to exceed ten per cent of the one-half allocated to each group of counties may be used and expended as state aid to joint county highway districts within such group.*

CONSTITUTIONALITY OF THE GASOLINE TAXATION IN CALIFORNIA UPHELD

The state highway officials of California are not only assured by the legislation described in this article of an adequate financial structure for state highway development in this state, but have the added satisfaction of having the gasoline tax law recently declared constitutional by the United States Circuit Court of Appeal.

ACCOUNTING AND FINANCIAL STATEMENTS

By E. R. Higgins, Chief Accountant

During the past biennium an important change in accounting procedure has been effected in the development of a comprehensive system of budgetary control. Budgetary accounts have been set up in the district offices corresponding to the control accounts in central office against which work orders are applied. At the end of the month the district offices prepare and forward to central office a "Statement of Allotments," showing the individual status of all work orders grouped according to the budgetary classifications. Central office is provided, through this medium, with current information as to the activity under the various work orders, and is aided in detecting and preventing possible overdrafts in allotments.

Our accounting problem is necessarily complex on account of the volume of business handled, and there are obvious advantages to be gained from an accounting standpoint if the financing of highway activities could be simplified.

During the past biennium the complexity of our financial problem has been magnified by the passage of the legislative act chapter 794, Statutes of 1927, classifying the state highway system into primary and secondary roads, and providing for the allocation of funds available for new construction, and reconstruction of state highways.

It has been further magnified by the creation of an additional fund, the State Highway Construction Fund, chapter 795, Statutes of 1927, into which is deposited the revenue received from the additional one cent gasoline tax, and from which expenditures for new construction are made.

It has been necessary to create new proprietary and budgetary accounts to record and control the expenditure of funds in accordance with the allocation provided for by these measures. It is not possible to preserve a current balance of expenditures in accordance with the allocation of funds provided by the above acts. However, at the conclusion of a biennium, through the control provided by the budgetary accounts, expenditures must of necessity be in accordance with the statutory provisions.

The period covered by this report represents the first two years of operation under the accounting system which was adopted on July 1, 1926. Our further experience under the system has demonstrated its value, and the results obtained have more than justified the initial investment in equipment.

Included in this appendix are the following statements reflecting the financial transactions of the Division of Highways, and condition of its funds and budgetary accounts as of June 30, 1928:

1. Statement of financial condition as of June 30, 1928.
2. Statement of income and expenditures.
   (Cumulative to June 30, 1928)
3. Status of budgetary accounts as of June 30, 1928:
   (a) State highway construction fund.
   (b) State highway maintenance fund.
   (c) Third state highway fund.
4. Statement of total expenditures by counties from bond funds including federal aid and contributions.
5. Expenditures July 29, 1927, to June 30, 1928, under provisions of chapter 794–1927.
6. Total expenditures of Division of Highways to June 30, 1928, segregated by funds.
7. Total expenditures of Division of Highways to June 30, 1928, functional classification.

DEPARTMENT OF PUBLIC WORKS, DIVISION OF HIGHWAYS—STATEMENT OF FINANCIAL CONDITION AS OF JUNE 30, 1928

FUNDING GROUP

Debits	
Available appropriated funds	$17,675,705 72
Credits	
Appropriations:	
Salaries of commissioners, 77th and 78th fiscal years; Chapter 30-1925	905 48
Reconstruction, widening and thickening, 77th and 78th fiscal years; Chapter 30-1925	328,574 60
Maintenance and repairs, 77th and 78th fiscal years; Chapter 30-1925	112,091 00
Overhead salaries, 77th and 78th fiscal years; Chapter 30-1925	50,158 41
Overhead support, 77th and 78th fiscal years; Chapter 30-1925	50,682 87
Deficiency resolution No. 40, 77th and 78th fiscal years	319,569 63
Joint highway districts, 77th and 78th fiscal years; Chapter 475-1925	50,000 00
Joint highway districts, 79th and 80th fiscal years; Chapter 142-1927	200,000 00
Administration, maintenance and reconstruction of highways, 79th and 80th fiscal years; Chapter 142-1927	15,933,688 87
Convict wages, 79th and 80th fiscal years; Chapter 653-1927	441,876 61
Rio Vista bridge, 79th and 80th fiscal years; Chapter 713-1927	9,767 29
Sutter By-Pass causeway, 79th and 80th fiscal years; Chapter 804-1927	178,390 96
Total	$17,675,705 72

[Other accounting and financial tables on following pages.]

DEPARTMENT OF PUBLIC WORKS, DIVISION OF HIGHWAYS—STATEMENT OF FINANCIAL CONDITION AS OF JUNE 30, 1928—Continued

PROPRIETARY GROUP

Debits				Credits	
Cash, commercial			$140,207 69	Schedules payable	$1,871,297 11
Cash, revolving funds:				Accounts payable, Public Works Building	200,000 00
Third state highway fund		$100,000 00		Reserve for convict camp fund	17,370 89
State highway maintenance fund		271,000 00	371,000 00	Surplus equipment department	105,236 35
Fund balances:				Accumulated excess income	13,794,811 46
Third state highway fund		953,044 88			
State highway maintenance fund		3,562,433 34			
State highway construction fund		5,007,452 28			
Highway general fund		42,562 21	9,565,492 71		
Convict camp fund			17,370 89		
Stores			228,026 74		
Fixed assets:					
Land and buildings	1,899,730 87				
Less reserves for depreciation and repairs	68,027 06	1,831,703 81			
Equipment	3,925,080 36				
Less reserve for depreciation	1,712,859 74	1,912,820 62	3,744,524 43		
Suspense accounts:					
Unapplied material		40,919 90			
Compensation suspense		13,333 62			
Clearing accounts		58,566 09			
Convict camp inventory		69,464 32	182,303 93		
Warrants receivable			1,739,189 42		
Total			$15,988,715 81	Total	$15,988,715 81

TRUST GROUP

Debits			Credits	
Cash-prisoners trust fund		$13,838 99	Prisoners' personal accounts	$13,838 99
Funds in treasury:			Liability for Sutter by-pass trust fund	25,000 00
Sutter By-pass trust fund	$25,000 00		Liability for prisoners' recreational fund	5 08
Prisoners' fund, recreational	5 08		Liability for canceled checks	5,675 15
Unclaimed trust money	5,675 15	30,680 83		
Total		$44,519 82	Total	$44,519 82

DEPARTMENT OF PUBLIC WORKS, DIVISION OF HIGHWAYS—STATEMENT OF INCOME AND EXPENDITURES SINCE THE INCEPTION OF THE CALIFORNIA HIGHWAY COMMISSION WITH THE BOND ISSUE OF 1909 TO JUNE 30, 1928

Income

Bond issues:		
First state highway bonds	$18,000,000 00	
Second state highway bonds	15,000,000 00	
Third state highway bonds	40,000,000 00	
Premiums and discounts on highway bonds	1,112,243 50	
		$74,112,243 50
Motor vehicle license fees apportionments		34,665,143 42
Gasoline tax apportionments (statutes 1923)		34,682,626 08
Gasoline tax apportionments (statutues 1927)		6,093,487 94
Transportation license tax apportionments (statutes 1923–1925)		249,572 93
Franchise tax—stage lines apportionments (statutes 1927)		234,111 07
Legislative appropriations from general fund		1,390,655 [illegible]
Federal aid, deposited in:		
First state highway fund	$33,173 03	
Second state highway fund	3,277,649 96	
Third state highway fund	15,308,533 60	
Motor vehicle fund	42,244 56	
State highway maintenance fund	2,414,229 46	
Highway general fund	235,154 90	
Used for discount	222,160 50	
		21,533,146 01
Contributions, deposited in:		
First state highway fund	$476,488 44	
Second state highway fund	488,126 02	
Third state highway fund	1,206,842 85	
Motor vehicle fund	50,197 82	
State highway maintenance fund	383,521 66	
State highway construction fund	10,661 02	
Highway general fund	584,437 09	
Chapter 769–17 fund	60,000 00	
Chapter 841–21 fund	1,250 00	
Chapter 832–21 fund	5,000 00	
		3,266,524 90
Total income		$176,227,511 48

Expenditures

First state highway fund:		
Highway construction-old routes	$17,867,308 38	
Administration, central office	272,101 01	
Administration, districts	372,381 08	
		$18,511,790 47
Second state highway fund:		
Highway construction, old routes	$18,057,075 79	
Administration, central office	254,165 30	
Administration, districts	454,559 89	
		18,765,800 98
Third state highway fund:		
Highway construction, old routes	$36,209,970 33	
Highway construction, new routes	18,907,646 63	
Administration, central office	724,219 22	
Administration, districts	820,428 34	
		56,662,264 52
State highway construction fund:		
Highway construction, primary north	$490,026 46	
Highway construction, primary south	222,923 92	
Highway construction, secondary north	195,234 67	
Highway construction, secondary north, joint highway districts	75,000 00	
Highway construction, secondary south	115,252 71	
		1,098,437 76
Highway general fund and legislative appropriations:		
Highway construction	$2,135,317 29	
Administration	98,618 12	
		2,233,935 41
State highway maintenance fund:		
Completed improvements, prior	$20,813,680 73	
Completed improvements, north	3,021,160 78	
Completed improvements, south	2,536,610 00	
Maintenance	36,097,236 47	
Administration, central office	1,044,470 91	
Administration, districts	1,647,311 90	
		65,160,470 88
Total expenditures		$162,432,700 02
Excess income over expenditures		$13,794,811 46

STATE HIGHWAY CONSTRUCTION FUND—STATUS OF BUDGETARY ACCOUNTS AS AT JUNE 30, 1928 FOR THE 79th AND 80th FISCAL YEARS

	Budget allotments	Contributions	Encumbrances by work orders issued	Unencumbered Balances of budget allotments
Preliminary surveys and plans:				
Primary north	$185,843 25		$43,265 85	$142,577 40
Primary south	153,906 75		96,623 14	57,283 61
Secondary north	56,625 00		54,924 33	1,700 67
Secondary south	56,625 00		19,645 13	36,979 87
Totals	$453,000 00		$214,458 45	$238,541 55
Right of way:				
Primary north	$309,738 75		$181,477 16	$128,261 59
Primary south	256,511 25		46,463 51	210,047 74
Secondary north	94,375 00		18,569 39	75,805 61
Secondary south	94,375 00		2,556 61	91,818 39
Totals	$755,000 00		$249,066 67	$505,933 33
Construction engineering:				
Primary north	$278,764 87		$36,183 18	$242,581 69
Primary south	230,860 13		11,700 00	219,160 13
Secondary north	84,937 50		15,802 08	69,135 42
Secondary south	84,937 50		1,000 00	83,937 50
Totals	$679,500 00		$64,685 26	$614,814 74
Major construction projects:				
Primary north	$4,033,434 10	$10,547 65	$1,489,052 87	$2,554,928 88
Primary south	3,397,500 00		415,674 20	2,981,825 80
Secondary north	1,257,789 90		419,089 78	838,700 12
Secondary south	1,250,000 00		407,123 27	842,876 73
Totals	$9,938,724 00	$10,547 65	$2,730,940 12	$7,218,331 53
Minor construction projects:				
Primary north	$410,250 00		$126,935 04	$283,314 96
Primary south	339,750 00		37,727 43	302,022 57
Secondary north	125,000 00		73,632 00	51,368 00
Secondary south	125,000 00		53,306 46	71,693 54
Totals	$1,000,000 00		$291,600 93	$708,399 07
Joint highway districts:				
Secondary north	$188,750 00		$75,000 00	$113,750 00
Secondary south	188,750 00			188,750 00
Totals	$377,500 00		$75,000 00	$302,500 00
Construction reserve:				
Primary north	$976,744 03			$976,744 03
Primary south	751,696 87			751,696 87
Secondary north	80,022 60			80,022 60
Secondary south	87,812 50			87,812 50
Totals	$1,896,276 00			$1,896,276 00
Summary:				
Primary north 54 7 % of 75 %	$6,194,775 00	$10,547 65	$1,876,914 10	$4,328,408 55
Primary south 45 3 % of 75 %	5,130,225 00		608,188 28	4,522,036 72
Secondary north 50 % of 25 %	1,887,500 00		657,017 58	1,230,482 42
Secondary south 50 % of 25 %	1,887,500 00		483,631 47	1,403,868 53
Totals S. H. C. F. budget 100 %	$15,100,000 00	$10,547 65	$2,625,751 43	$11,484,796 22

STATE HIGHWAY MAINTENANCE FUND—STATUS OF BUDGETARY ACCOUNTS AS AT JUNE 30, 1928 FOR THE 79th AND 80th FISCAL YEARS

	Budget allotments	Contributions	Encumbrances by work orders issued	Unencumbered Balances of budget allotments
Preliminary surveys and plans, north	$267,172 86		$138,526 11	$128,646 75
Preliminary surveys and plans, south	221,260 16		123,916 18	97,343 98
Right of way, north	445,288 11		172,031 48	273,256 63
Right of way, south	368,766 93		111,874 17	256,892 76
Improvement engineering, north	400,759 30		175,564 20	225,195 10
Improvement engineering, south	331,890 24		119,962 14	211,928 10
Major improvements, north	6,392,495 46	$53,574 95	3,859,003 00	2,587,067 41
Major improvements, south	5,649,077 75	25,869 81	2,882,098 60	2,792,848 96
Minor improvements, north	1,114,500 00		634,393 27	480,106 73
Minor improvements, south	582,500 00		258,171 02	324,328 98
Improvement reserve, north	263,686 54			263,686 54
Improvement reserve, south	203,740 25			203,740 25
Subtotals, north 54 7 %	8,883,902 27	53,574 95	4,979,518 06	3,957,959 16
Subtotals, south 45 3 %	7,357,235 33	25,869 81	3,496,022 11	3,887,083 03
Totals, reconstruction 100%	$16,241,137 60	$79,444 76	$8,475,540 17	$7,845,042 19
General maintenance	$6,678,583 73		$6,651,163 73	$27,420 00
Major slides	800,000 00		427,117 40	372,882 60
Specific maintenance	900,000 00		528,203 85	371,796 15
Oil processing	780,000 00		648,842 57	131,157 43
Building and plants	400,000 00		163,378 79	236,621 21
New equipment	250,000 00	$692,444 94	942,444 94	
Administration (79th fiscal year)	988,621 43		861,652 81	126,968 62
Administration (80th fiscal year)	1,033,147 22			1,033,147 22
Totals, S. H. M. fund budget	$28,071,489 98	$771,889 70	$18,698,344 26	$10,145,035 42

NOTE—Amount added to new equipment allotment in the column "Contributions," represents reserve accumulated by the Equipment Department for replacement of equipment.

THIRD STATE HIGHWAY FUND—STATUS OF BUDGETARY ACCOUNTS AS AT JUNE 30, 1928 FOR THE 79th AND 80th FISCAL YEARS

	Budget allotments	Encumbrances by work orders issued	Unencumbered balances of budget allotments
Convict construction:			
Preliminary surveys and plans	$72,488 04	$51,644 23	$20,843 81
Right of way	79,146 73	12,299 91	66,846 82
Construction engineering	71,232 06	13,950 00	57,282 06
Construction projects	1,385,067 81	530,025 00	855,042 81
Reserve for bridges	500,000 00	252,371 94	247,628 06
Reserve for contingencies	142,065 36		142,065 36
Totals	$2,250,000 00	$860,291 08	$1,389,708 92
New construction, north:			
Preliminary surveys and plans	$54,691 82	$5,620 00	$49,071 82
Right of way	91,153 03		91,153 03
Construction engineering	82,037 73		82,037 73
Construction projects	423,506 03	423,506 03	
Unalloted reserve	1,171,671 95		1,171,671 95
Totals	$1,823,060 56	$429,126 03	$1,393,934 53
New construction, south:			
Preliminary surveys and plans	$45,293 22		$45,293 22
Right of way	75,488 70	$7 66	75,481 04
Construction engineering	67,939 83	1,000 00	66,939 83
Construction projects	397,513 71	34,449 98	363,063 73
Unallotted reserve	923,538 62		923,538 62
Totals	$1,509,774 08	$35,457 64	$1,474,316 44
Totals, third state highway fund budget	$5,582,834 64	$1,324,874 75	$4,257,959 89

DEPARTMENT OF PUBLIC WORKS, DIVISION OF HIGHWAYS—STATEMENT OF EXPENDITURES MADE TO JUNE 30, 1928, FROM THE FIRST, SECOND AND THIRD STATE HIGHWAY FUNDS, INCLUDING AMOUNTS OF FEDERAL AID DEPOSITED IN THOSE FUNDS, ALSO A STATEMENT OF CONTRIBUTION EXPENDITURES

	First state highway fund	Second state highway fund	Third state highway fund	Total expenditures bond funds	Contribution expenditures
Alameda	$452,652 79	$337,977 72	$289,543 77	$1,080,174 28	$2,143 86
Alpine					
Amador	406 49	20,077 19	336,505 33	356,989 01	11,395 72
Butte	306,654 17	604,903 25	659,994 78	1,571,552 20	41,350 00
Calaveras	5,793 78	125,468 00	24,335 55	155,597 33	20,200 00
Colusa	493,128 12	14,284 99	328,687 75	836,100 86	57,860 47
Contra Costa	270,466 99	246,896 40	87,309 16	604,672 55	19,056 93
Del Norte	10,976 95	477,713 06	2,433,897 99	2,922,588 00	15,000 00
El Dorado	287,149 73	262,485 98	49,089 58	598,725 29	7,768 77
Fresno	248,399 38	266,804 65	897,820 32	1,413,024 35	
Glenn	250,413 29	12,498 44	213,050 45	475,962 18	80,046 28
Humboldt	673,221 05	1,179,025 64	3,376,654 89	5,228,901 58	216,729 87
Imperial	404,805 41	811,655 38	2,475,726 54	3,692,277 33	64,730 48
Inyo	21,609 25	184,477 67	576,691 12	782,778 04	
Kern	882,644 61	229,642 63	2,606,173 18	3,718,460 42	114,975 79
Kings	106,554 38	62,218 96	393,994 59	562,767 93	
Lake	16 04	32,920 56	632,130 33	665,066 93	5,000 00
Lassen	714 35	82,344 42	596,875 66	679,934 43	183,601 93
Los Angeles	1,284,762 35	1,385,290 09	2,875,737 18	5,545,789 62	69,125 01
Madera	220,476 65	44,930 29	373,369 26	638,776 20	12,360 00
Marin	236,080 41	451,034 01	223,519 58	910,634 00	40,500 00
Mariposa	190,337 16	787,375 44	1,321,819 29	2,299,531 89	124,455 49
Mendocino	789,719 41	1,048,039 99	1,616,708 05	3,454,467 45	62,048 27
Merced	342,940 97	151,913 91	1,517,903 96	2,012,758 84	3,448 68
Modoc	33 06	59,752 94	399,884 17	459,670 17	44,718 94
Mono	88,025 19	160,582 73	395,443 03	644,050 95	
Monterey	618,929 66	928,130 66	1,675,950 39	3,223,010 71	107,364 58
Napa	19,330 09	182,462 33	364,409 82	566,202 24	67,228 93
Nevada	8,063 46	285,295 92	1,919,299 51	2,212,658 89	69,894 47
Orange	528,938 27	86,602 55	1,855,803 57	2,471,344 39	51,378 33
Placer	364,093 99	78,636 45	1,233,167 76	1,675,898 20	29,672 93
Plumas	58 58	4,870 20	364,505 06	369,433 84	2,500 00
Riverside	92,442 11	385,393 39	1,776,488 06	2,254,323 56	110,947 75
Sacramento	103,912 03	29,761 55	83,691 44	217,365 02	35,280 98
San Benito	230,836 93	1,329 21	232,947 45	465,113 59	74,709 52
San Bernardino	261,021 75	86,790 42	978,128 61	1,325,940 78	38,979 02
San Diego	622,188 21	645,759 39	1,024,510 81	2,292,458 41	171,481 52
San Francisco		6 00	132,550 42	132,556 42	522,415 56
San Joaquin	4,278 08	124,715 51	212,546 52	341,540 11	
San Luis Obispo	823,571 26	392,370 20	1,498,403 77	2,714,345 23	80,012 97
San Mateo	439,521 30	40,955 76	1,508,757 00	1,989,234 06	64,345 65
Santa Barbara	839,664 59	709,384 44	1,661,393 17	3,210,442 20	113,715 75
Santa Clara	926,022 63	259,876 81	952,560 17	2,129,459 61	39,000 00
Santa Cruz	215,027 48	171,213 61	215,446 11	601,687 20	
Shasta	481,030 22	1,035,361 27	1,370,511 10	3,486,902 59	72,643 18
Sierra	17,763 75	163,946 58	200,709 73	382,420 06	17,749 68
Siskiyou	386,473 19	178,759 40	1,718,041 54	2,283,274 13	80,853 60
Solano	402,995 94	185,154 23	693,806 56	1,281,956 73	22,879 98
Sonoma	494,848 22	347,593 92	1,501,345 76	2,343,784 90	84,931 49
Stanislaus	305,356 18	84,306 39	295,914 82	685,577 39	14,103 47
Sutter	107,620 68	53 31	302,813 13	410,487 12	25,463 59
Tehama	297,610 42	268,993 15	1,562,297 62	2,128,901 19	55,408 42
Trinity	7,029 96	215,869 22	1,259,541 73	1,482,440 91	1,000 00
Tulare	245,345 67	498,449 13	202,937 29	946,732 09	1,997 54
Tuolumne	129,775 75	38,849 47	326,970 02	495,595 84	10,897 18
Ventura	607,294 54	58,085 47	1,467,212 15	2,132,592 16	
Yolo	762,134 78	336,244 38	421,527 31	1,519,906 47	26,328 67
Yuba	121,951 33	112,418 11	187,948 04	422,317 48	16,819 00
Totals, counties	$18,033,173 03	$17,568,949 77	$53,905,002 55	$89,507,125 35	$3,206,520 25
Undistributed	2,129 00	708,725 19	1,082,736 17	2,393,590 36	
Totals, bond issues and federal aid	$18,035,302 03	$18,277,674 96	$55,587,738 72	$91,900,715 71	
Less federal aid	33,173 03	3,277,649 96	14,255,488 72	17,566,311 71	
Totals, bond issues	$18,002,129 00	$15,000,025 00	$41,332,250 00	$74,334,404 00	

RECAPITULATION OF EXPENDITURES JULY 29, 1927, TO JUNE 30, 1928, UNDER PROVISIONS OF CHAPTER 794, 1927

	Total expenditures	Less contribution	Net expenditures
State highway maintenance fund—improvements:			
Account 302, north	$3,021,160 78	$53,574 95	$2,967,585 83
Account 304, south	2,536,610 09	25,869 81	2,510,740 28
Totals	$5,557,770 87	$79,444 76	$5,478,326 11
State highway construction fund—construction:			
Account 402, primary north	$490,026 46	$10,661 02	$479,365 44
Account 404, primary south	222,923 92		222,923 92
Account 412, Account 432, secondary north	270,234 67		270,234 67
Account 414, secondary south	115,252 71		115,252 71
Totals	$1,098,437 76	$10,661 02	$1,087,776 74

STATE HIGHWAY MAINTENANCE FUND NET EXPENDITURES IN 45 NORTHERN AND 13 SOUTHERN COUNTIES FOR IMPROVEMENT WORK, IN LINE WITH PROVISIONS OF CHAPTER 794 STATUTES OF 1927

(Total expenditures less contributions)

Counties	Account 302 45 northern counties	Account 304 13 southern counties
Alameda	$504,184 63	
Alpine	3,761 52	
Amador	43,938 96	
Butte	499 88	
Calaveras	4,759 39	
Colusa	59,495 08	
Contra Costa	85,464 37	
Del Norte	67,365 53	
El Dorado	136,509 53	
Fresno	27,722 08	
Glenn	23,051 34	
Humboldt	68,123 98	
Imperial		$156,269 82
Inyo		80,470 97
Kern		452,556 34
Kings	298 58	
Lake	15,293 53	
Lassen	9,469 67	
Los Angeles		193,105 72
Madera	67,506 68	
Marin	34,198 09	
Mariposa	157,288 71	
Mendocino	48,019 30	
Merced	61,108 40	
Modoc	5,989 20	
Mono		25,230 55
Monterey	116,052 28	
Napa	20 35	
Nevada	9,431 24	
Orange		278,916 43
Placer	120,358 29	
Plumas	11 66	
Riverside		7,301 14
Sacramento	234,247 46	
San Benito	75 92	
San Bernardino		555,146 25
San Diego		183,993 73
San Francisco	8 51	
San Joaquin	144,187 52	
San Luis Obispo		344,762 90
San Mateo	188,974 62	
Santa Barbara		172,918 82
Santa Clara	85,403 07	
Santa Cruz	1,739 47	
Shasta	480,123 52	
Sierra	129 99	
Siskiyou	13,219 67	
Solano	25,104 81	
Sonoma	33,033 16	
Stanislaus	33,312 32	
Sutter	58 94	
Tehama	17,732 50	
Trinity	13,478 15	
Tulare		6,368 94
Tuolumne	20,604 24	
Ventura		53,698 67
Yolo	4,417 27	
Yuba	1,212 42	
Totals	$2,967,585 83	$2,510,740 28

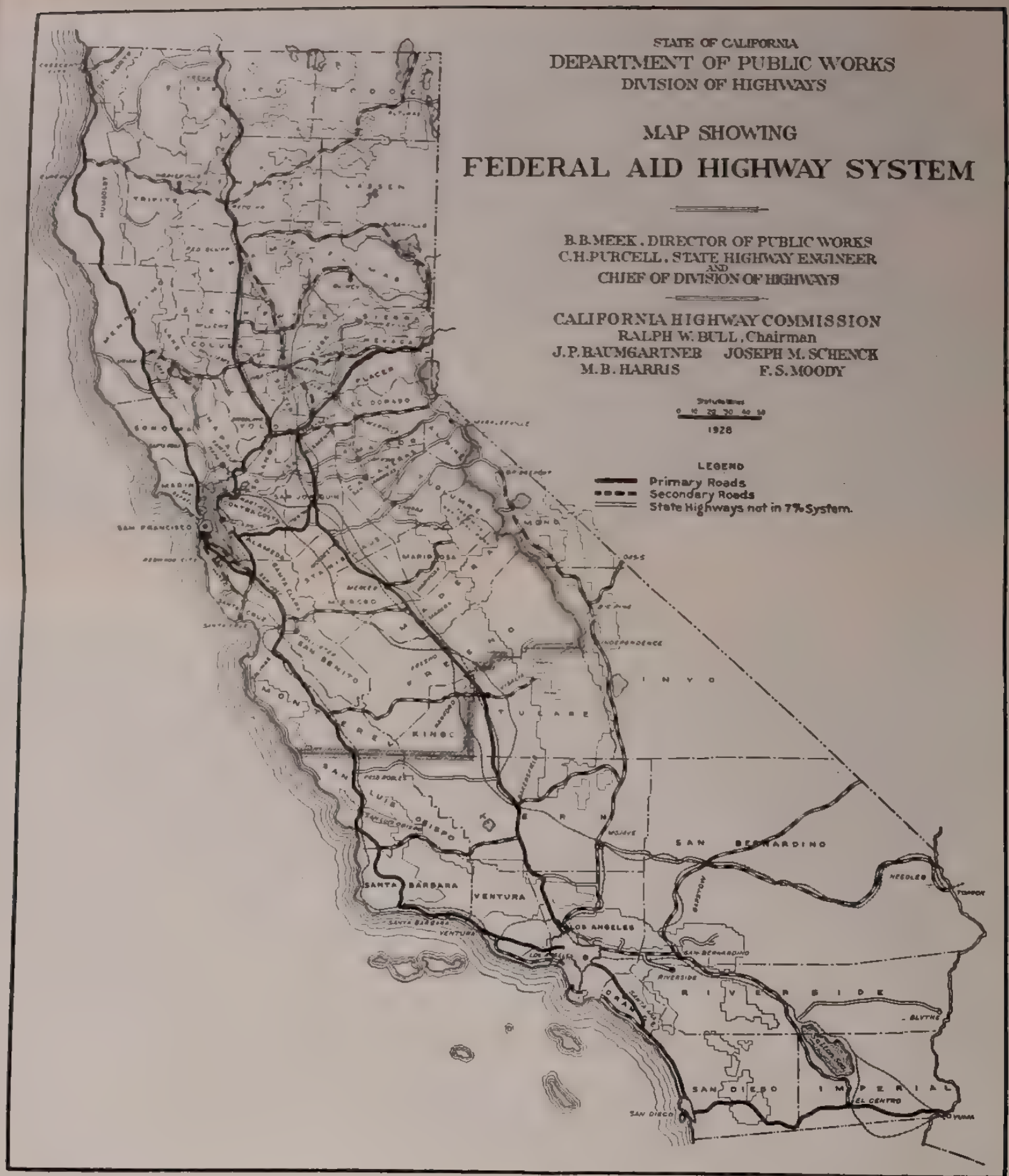
STATE HIGHWAY CONSTRUCTION FUND—NET EXPENDITURES IN 45 NORTHERN AND 13 SOUTHERN COUNTIES FOR NEW CONSTRUCTION IN LINE WITH THE PROVISIONS OF CHAPTER 794, STATUTES OF 1927

(Total expenditures less contribution expenditures)

Counties	Account 402 Primary north	Account 404 Primary south	Account 412 Secondary north	Account 414 Secondary south	Totals
Alameda					
Alpine	$2,203 98				$2,203 98
Amador	9,078 31		$2,963 44		12,041 75
Butte			22,547 37		22,547 37
Calaveras			4,461 25		4,461 25
Colusa			1,203 68		1,203 68
Contra Costa	2,271 61				2,271 61
Del Norte	135,644 57				135,644 57
El Dorado			12,185 90		12,185 90
Fresno	5,087 87				5,087 87
Glenn	2,205 30		22,418 79		24,624 09
Humboldt	13,910 59				13,910 59
Imperial		$418 51			418 51
Inyo		3,184 42			3,184 42
Kern		581 03		$7,440 13	8,021 16
Kings					
Lake			11,279 53		11,279 53
Lassen	12,686 27		180 46		12,866 73
Los Angeles		149,724 11		610 24	150,334 35
Madera	5,145 69		1,165 14		6,310 83
Marin			369 10		369 10
Mariposa					
Mendocino	57 41		1,901 36		1,958 77
Merced					
Modoc	623 92		2,922 03		3,545 95
Mono		389 99			389 99
Monterey	823 52				823 52
Napa					
Nevada	3,403 97		2,228 56		5,632 53
Orange		9,573 38			9,573 38
Placer	35,915 74		7,543 28		43,459 02
Plumas	11,462 69				11,462 69
Riverside		8,541 88			8,541 88
Sacramento					
San Benito			4,693 11		4,693 11
San Bernardino		14,853 48		104,952 49	119,805 97
San Diego		6,241 04			6,241 04
San Francisco					
San Joaquin	5,729 46				5,729 46
San Luis Obispo				2,249 85	2,249 85
San Mateo	217,593 33		41,030 13		258,623 46
Santa Barbara					
Santa Clara	1,666 58		27,149 50		28,816 08
Santa Cruz			25,188 84		25,188 84
Shasta	4,200 91				4,200 91
Sierra			2 09		2 09
Siskiyou	53 05				53 05
Solano	565 08		60 00		625 08
Sonoma	56 25				56 25
Stanislaus					
Sutter					
Tehama	8,177 47				8,177 47
Trinity	768 24				768 24
Tulare					
Tuolumne	33 63		3,741 11		3,774 74
Ventura		29,416 08			29,416 08
Yolo					
Yuba					
Totals	$479,365 44	$222,923 92	$195,234 67	$115,252 71	$1,012,776 74
Account 432 joint highway districts, north			75,000 00		75,000 00
Grand totals	$479,365 44	$222,923 92	$270,234 67	$115,252 71	$1,087,776 74

EXPENDITURES BY DIVISION OF HIGHWAYS TO JUNE 30, 1928—BY FUNDS

Fiscal Year Ending June 30.	Bond Issues	Federal Aid	Contributions	One Cent Gasoline Tax	Motor Vehicle License Fees & 2 Cent Gas. Tax	State General Fund Appropriations	GRAND TOTAL
1911-1912	154,195.12					6,933.33	161,128.45
1912-1913	1,329,540.99					20,800.00	1,350,340.99
1913-1914	2,371,873.56				4,655.17	20,800.00	2,397,328.73
1914-1915	6,777,309.41				194,931.53	20,800.00	6,993,040.94
1915-1916	6,165,691.79				1,053,667.58	20,800.00	7,240,159.37
1916-1917	1,866,731.96				850,331.06	37,621.34	2,754,684.36
1917-1918	3,991,188.60	59,571.76	531,767.98		804,092.44	22,696.40	5,409,317.18
1918-1919	4,839,537.67		78,338.27		1,350,786.55	46,815.49	6,315,577.98
1919-1920	7,280,466.91	222,160.50	22,014.48		1,522,085.59	73,750.76	9,120,479.24
1920-1921	4,903,797.18	1,272,640.54	257,584.66		2,413,405.12	20,820.00	8,868,247.50
1921-1922	11,686,534.20	2,254,615.01	54,079.66		3,708,906.72	46,573.91	17,750,709.50
1922-1923	10,584,968.96	2,969,295.33	80,272.35		4,091,974.39	355,233.39	18,181,744.42
1923-1924	7,072,759.28	2,523,093.33	402,279.92		6,095,088.11	222,773.65	16,475,994.29
1924-1925	2,878,412.08	3,371,711.00	498,003.31		8,837,061.52	228,407.47	15,813,595.38
1925-1926	1,459,787.74	3,387,067.83	486,316.12		10,630,084.76	201,703.56	16,064,960.01
1926-1927	549,342.05	2,841,881.29	328,165.21		12,093,997.80	69,894.52	15,983,285.87
1927-1928		1,475,502.33	527,702.94	1,086,035.66	12,546,950.82	249,965.14	15,886,156.89
Totals to June 30, 1928	74,112,243.50	20,437,538.92	3,266,524.90	1,086,035.66	66,198,020.16	1,666,388.96	166,766,752.10


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
MAP SHOWING
FEDERAL AID HIGHWAY SYSTEM
B.B.MEEK, DIRECTOR OF PUBLIC WORKS
C.H.PURCELL, STATE HIGHWAY ENGINEER
AND
CHIEF OF DIVISION OF HIGHWAYS
CALIFORNIA HIGHWAY COMMISSION
RALPH W. BULL, Chairman
J.P.BAUMGARTNER
JOSEPH M. SCHENCK
M.B. HARRIS
F.S.MOODY
1928
LEGEND
Primary Roads
Secondary Roads
State Highways not in 7% System.
SAN FRANCISCO
INYO
TULARE
KINGS
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
RIVERSIDE
SAN DIEGO
IMPERIAL
NEEDLES
BLYTHE
EL CENTRO

EXPENDITURES BY DIVISION OF HIGHWAYS TO JUNE 30, 1928—CLASSIFIED

	Total to June 30, 1928		Jul. 1, 1927–Jun. 30, 1928		Jul. 1, 1926–Jun. 30, 1927		Jul. 1, 1925–Jun. 30, 1926		Jul. 1, 1924–Jun. 30, 1925		Jul. 1, 1923–Jun. 30, 1924		Mar. 1, 1912–Jun. 30, 1923	
ITEM	AMOUNT	%	AMOUNT	%	AMOUNT	%	AMOUNT	%	AMOUNT	%	AMOUNT	%	AMOUNT	%
Preliminary Surveys & Plans	4,538,463.47	2.78	425,034.39	2.70	245,045.41	1.56	530,821.55	1.67	851,437.28	2.46	823,241.87	3.32	1,644,902.89	4.06
Engineering & Inspection in connection with Construction and Improvement Work	5,342,005.10	3.20	445,475.93	2.80	435,084.11	2.72	982,984.37	3.08	1,138,362.53	3.28	737,855.07	2.77	1,602,203.09	3.84
Right of Way	1,051,587.47	.64	451,805.21	2.84	387,150.95	2.42	218,985.39	.68	4,574.91	.01	—		—	
Construction & Improvement Work - Day Labor	27,920,852.51	15.74	2,387,442.54	15.03	2,426,108.11	15.18	4,120,500.17	12.93	5,332,751.16	15.35	5,313,364.09	19.96	8,340,686.44	19.98
Construction & Improvement Work - Contract	81,527,448.79	48.88	6,436,629.73	40.52	6,906,251.64	43.21	16,949,895.53	53.17	17,450,236.17	50.35	11,915,546.17	44.76	21,868,849.55	52.39
Total Construction and Improvement	120,490,377.34	72.24	10,150,388.80	63.89	10,403,680.23	65.09	22,802,257.11	71.53	24,777,362.03	71.49	18,850,047.20	70.81	33,506,641.97	80.27
Maintenance Work	33,966,892.15	20.37	4,458,955.52	28.07	5,647,869.04	35.33	7,463,751.93	23.41	6,549,108.23	19.19	5,091,572.78	19.13	4,655,634.65	11.15
Maintenance Engineering	12,414.00	.01	4,038.31	.03	8,375.65	.05	--		--		--		--	
Equipment, Plants & Stores	4,215,085.23	2.53	422,231.89	2.66	-896,313.58	-5.60	157,511.55	.49	1,575,442.65	4.83	1,434,105.32	5.39	1,422,107.36	3.41
Totals	158,684,768.72	95.15	15,035,614.52	94.65	15,163,611.32	94.87	30,423,520.63	95.43	33,101,912.91	95.51	25,375,725.30	95.33	39,584,383.98	94.83
Administration Expense at District Offices	4,642,907.80	2.78	491,073.92	3.09	474,306.26	2.97	821,504.89	2.58	850,371.96	2.45	733,969.12	2.76	1,271,681.65	3.05
Administration Expense at Central Office	3,163,342.25	1.90	359,468.45	2.26	335,359.23	2.10	613,529.87	1.93	674,653.84	1.95	467,662.58	1.75	712,658.28	1.71
Salaries Paid Direct by Controller	275,733.33	.17			10,000.00	.06	20,000.00	.06	30,800.00	.09	41,600.00	.16	173,333.33	.41
Totals	8,081,983.38	4.85	850,542.37	5.35	819,675.49	5.13	1,455,034.76	4.57	1,555,825.80	4.49	1,243,231.70	4.67	2,157,673.26	5.17
GRAND TOTALS	166,766,752.10	100.00	15,886,156.89	100.00	15,983,286.87	100.00	31,878,555.39	100.00	34,657,738.71	100.00	26,618,957.00	100.00	41,742,057.24	100.00
FUNDS FROM WHICH EXPENDITURES WERE MADE														
Bond Issues	74,112,243.50		—		549,348.05		4,338,199.82		17,757,728.24		16,590,331.38		34,776,635.01	
Motor Vehicle and State Highway Maintenance Funds	66,198,020.16		12,546,950.82		12,093,957.80		19,467,146.28		10,187,062.50		6,122,311.84		5,780,550.92	
State Highway Construction Fund	1,085,035.66		1,085,035.66		—		—		—		—		—	
Federal Aid	20,437,538.92		1,475,502.33		2,841,881.29		6,658,778.83		5,652,388.66		3,527,255.55		281,732.26	
Contributions by Counties	3,266,524.90		527,702.94		328,165.21		984,319.43		482,552.27		311,664.32		632,120.73	
State General Fund	1,666,388.96		249,965.14		69,894.52		430,111.03		578,007.04		67,393.91		271,017.32	
Totals	166,766,752.10		15,886,156.89		15,983,286.87		31,878,555.39		34,657,738.71		26,618,957.00		41,742,057.24	

- Credit

BALANCE STATEMENT FEDERAL AID JUNE 30, 1928

Total federal aid apportioned to California to June 30, 1929		$27,042,667 00
Federal aid under agreement	$22,854,629 31	
Plans, specifications and estimate recommended for agreement by District Engineer U. S. B. P. R.	1,153,892 35	
Estimates submitted to Bureau of Public Roads for agreement	161,885 44	
Contracts pending award or advertised (estimated)	717,600 00	
Total liabilities		$24,888,007 10
Balance available for allotment to specific projects June 30, 1929		$2,154,659 90
Allotment for 1930 and 1931 (estimated)		4,972,830 00
Total available		$7,127,489 90

FEDERAL AID ALLOTMENTS

$75,000,000 Fund

Fiscal year ending June 30, 1917	$151,063 92	
Fiscal year ending June 30, 1918	302,127 84	
Fiscal year ending June 30, 1919	456,167 23	
Fiscal year ending June 30, 1920	609,699 32	
Fiscal year ending June 30 1921	763,668 88	
Subtotal		2,282,727 19

$200,000,000 Fund

Fiscal year ending June 30, 1919	$1,524,248 30	
Fiscal year ending June 30, 1920	2,286,372 45	
Fiscal year ending June 30, 1921	2,291,006 63	
Subtotal		6,101,627 38

$75,000,000 Fund

Fiscal year ending June 30, 1922	$2,462,098 53	
Subtotal		2,462,098 53

$190,000,000 Fund

Fiscal year ending June 30, 1923	$1,641,399 02	
Fiscal year ending June 30, 1924	2,140,463 10	
Fiscal year ending June 30, 1925	2,487,157 78	
Subtotal		6,269,019 90

$150,000,000 Fund

Fiscal year ending June 30, 1926	$2,472,636 00	
Fiscal year ending June 30, 1927	2,484,706 00	
Subtotal		4,957,342 00

$150,000,000 Fund

Fiscal year ending June 30, 1928	2,483,437 00	
Fiscal year ending June 30, 1929	2,486,415 00	
Subtotal		4,969,852 00
Total to June 30, 1929		$27,042,667 00

$150,000,000 Fund

Fiscal year ending June 30, 1930 (estimated)	$2,486,415 00	
Fiscal year ending June 30, 1931 (estimated)	2,486,415 00	
Subtotal		4,972,830 00
Total		$32,015,497 00

Project Number	Contract Number	Road	Location	Length Miles	Type	Plans & Est Approved by Dist. Engr.	Project Agreement Executed	Total Estimated Cost *	Amount of Federal Aid Alloted or Requested	Reimbursements	Date of Completion
1	167	IV-SM-1-B	Beresford to Redwood City	4.24	20 ft. Concrete Pav.	11-15-16	3-29-17	$ 83,368	$ 35,327.20	$ 35,327.20	3-18-17
1-R	350	IV-SM-2-B	Beresford to Redwood City		20 ft. Asph. Concrete Surf.	3-22-21	10-29-21	63,963	16,372.80	$ 16,372.80	10-29-21
1-A	W-106	VII-Ven-2-B,C	Camarillo To Ventura	13.19	20 ft. P.C. Conc. Pav. Widen	10-20-25	1-16-26	403,401	257,617.85	$ 257,457.70	8-28-26
1	170	IV-CC-14-A	Southerly Boundary to Richmond	2.59	20 ft. Asph. on Concrete Base	10-18-16	11-21-16	54,480	24,244.56	$ 24,244.56	7-26-17
1		I-Rm-1-C	Loleta to Beatrice		Withdrawn						
1		III-Pla-17-A	Rosaville to Penryn		Withdrawn						
1		II-Sha-3-C	Across Sacramento Riv.& Salt Creek		Withdrawn						
1	241	II-Shn-20-A,B	Tower House to Redding	15.94	Grading	6-14-18	6-24-18	288,163	105,334.24	$ 105,334.24	7-21-20
1-A	370	II-Tri-20-B	White Bar Creek to Helena	11.40	Grading; Concrete Bridge	4- 1-19	6- 2-19	315,294	155,492.15	$ 155,492.15	6-12-20
1-B	354	II-Tri-20-D	Burnt Ranch to Waits Bar Creek	15.63	Grading	5- 5-21	6-28-21	453,362	211,158.36	$ 211,158.36	6-15-25
1-C	354	II-Tri-20-F	Helena to 5.147 Miles East	2.53	Grading	5-15-23	9-28-23	110,586	45,806.94	$ 45,291.66	6-15-25
9	231	VII-SD-12-G	Tecate Divide to Easterly Boundary	15.21	Grading & 15 ft.Concrete Pav	9-20-18	1- 8-19	586,012	121,913.95	$ 121,913.95	12-18-20
10	256	II-Mod-28-A	Adin Summit to Cuby	10.85	Grading	3-28-19	6- 2-19	272,812	39,358.82	$ 39,358.82	10-28-20
11	345	VII-Fre-10-B	Coalinga to Oil King School	8.07	18 ft. Concrete Paving	6- 5-19	8-29-19	262,956	123,334.14	$ 123,334.14	5-24-25
12	246	VI-Mer-18-A	Merced to Easterly Boundary	14.89	15 ft. Concrete Paving	5-23-19	8- 1-19	390,000	133,333.92	$ 133,333.92	8-28-21
13	047	VII-LA-4-B,C	Kay Ranch to Lilmore Mountain	17.62	20 ft. Concrete Paving	6- 7-19	8-29-19	429,363	155,194.05	$ 136,404.84	11-15-19
14-A	208	I-Men-1-G,H	Arnold to Rattlesnake Summit	24.12	Grading	5-29-19	8- 1-19	277,972	76,473.46	$ 76,473.46	9-30-20
14	326	VI-Mon-2-F	Across Owlings River	.50	Steel Br. Conc. Trestle & Surf.	6-18-19	9-11-19	321,565	142,701.79	$ 142,701.79	6-16-22
16-A	249	I-Hum-1-J	Freshwater Lagoon to Orick	2.80	Grading	6- 5-19	8- 1-19	48,894	19,735.78	$ 19,735.78	5- 9-20
16-B	524,911	I-Hum-1-K	Orick to Northerly Boundary	15.06	Grading,Surfacing, 3 Bridges.	5- 4-27	5-22-28	607,505	349,504.78	221,921.73	
17	248	I-DN-1-B	Last Chance Slide-Cushion Creek	7.73	Grading	6- 3-19	8-11-19	497,444	119,522.92	$ 119,566.92	10-1-20
18-A	275	I-Hum-1-G	Beatrice to Eureka	7.43	15 ft. Concrete Paving	10- 8-19	1-17-20	307,150	75,823.48	$ 75,823.48	11-1-20
19	247	IV-Men-16-A	Hopland to Easterly Boundary	9.73	Grading	6-18-19	8-29-19	180,160	58,684.00	$ 58,684.00	7-21-20
20	353	IV-Lak-16-A	Westerly Boundary to Lakeport	9.36	Grading	6-11-19	9- 2-19	149,623	58,351.01	$ 58,351.01	11-15-20
21	261	VII-Ven-2-A,B	Southerly Bdry. to Conejo Grade	5.19	18 ft. Concrete Paving	8-13-19	10-11-19	164,157	83,442.70	$ 78,900.38	12-13-20
21-R	W- 40	VII-Ven-2-A,B	Southerly Bdry. to Camarillo	9.84	Widen Gr.,2nd Stly Conc.& Shlds.	2- 9-24	7-25-24	356,559	194,994.72	$ 194,223.14	12-13-24
22	257	VII-LA-2-G	Russel Ranch to Westerly Bdry.	1.29	18 ft. Concrete Paving	8-13-19	10-11-19	42,994	21,155.20	$ 19,043.20	9-18-20
22-R	W- 34	VII-LA-3-C	Russel Ranch to Westerly Bdry.		Widen Roadway	1- 2-24	6-18-24	3,811	3,305.16	$ 2,248.75	10- 6-24
23	251	VII-LA-2-A	Lankershim Blvd. to S.Sherman Way	5.23	30 ft.Conc.Paving & Tonk. Surf.	8-15-19	10-11-19	62,294	50,035.42	$ 31,026.66	2- 4-20
24-A	252	VII-Ora-2-B	Calivan to Irvine	9.37	15 ft.Topk.Surf.& Conc.Shlds.	8-28-19	11-19-19	108,232	69,944.65	$ 53,973.08	2-26-20
24-A-R	526,911	VII-Ora-2-B	Calivan to 2# Mi. S. E. of Irvine		Grading,Surf. 2 Bridges	9-16-27	1-19-28	300,870	105,650.10	72,305.50	
24-B	W- 43	VII-Ora-2-A	San Juan Cr. to Easterly Bdry.	9.45	Widen Roadway	4-15-24	8-23-24	42,949	23,515.45	$ 23,515.45	11-15-24
24-C	W-TM-W- 74	VII-Ora-3-A	San Juan Cr. to Calivan	5.61	30' P.C.Conc.Paving,Conc. Br.	4-11-25	9-14-25	228,872	117,854.62	$ 117,854.62	2- 8-26
24-D	W-130	VII-Ora-2D	Across Santa Ana River	.20	Concrete Bridge Pav. Appr.	5-22-26	9-20-26	114,507	63,804.18	$ 60,872.28	4-25-27
24-E	W-147	VII-Ora-3-C	Thru Tustin	1.63	38 ft. Concrete Paving	9- 1-26	12-31-26	69,531	29,364.45	$ 29,364.45	5-11-27
25-A	255	V-SB-2-A	Divide to Orcutt	3.56	15 ft. Concrete Pav.	8-18-19	11-18-19	81,509	42,686.98	$ 39,571.20	6- 4-20
25-B	485	V-S.L.O-3-E	Pismo to 1 mile South	.97	Grading,Surf. 3 Conc. Bridges	6- 6-25	9-25-25	119,615	51,668.55	$ 48,525.59	7-31-26
25-C	496	V-S.L.O-2-F	Across Santa Maria River	.37	Concrete Bridge,Pav.Appr.	3-26-26	8- 7-26	112,828	70,910.66	$ 66,249.26	2-23-27
25-D	502	V-S.L.O-3-E	Pismo to San Luis Obispo	10.76	Grading,20'Conc.Pav. 1 Bridge	9-23-27	1-18-28	432,398	172,310.57	55,610.58	
26	249	VI-Ker-4-A	Southerly Bdry. to Grapevine Sta.	10.73	20 ft. Concrete Paving	8-18-19	11-18-19	481,983	164,799.30	$ 164,799.30	7-22-21
27	254	X-Sta-13-B	Oakdale to Easterly Bdry.	12.79	15 ft. Concrete Pavving	9-11-19	12-10-19	267,960	128,917.83	$ 115,326.57	3- 3-21
28	538	III-Pla-17-C	Auburn to Northerly Bdry.	6.68	15 ft. Asphalt Macadam	6- 1-21	8-10-21	215,867	90,022.40	$ 90,022.40	10- 5-22
29	299	X-Ama-34-B	Ione to Jackson	10.74	Grading	9-12-19	12-10-19	108,513	35,914.29	$ 35,914.29	7-14-22
30		X-Tuo-13-A,B	Westerly Bdry. to Sonora		Withdrawn						
31	344	I-DN-1-B	Cushion Creek to Crescent City	4.08	Grading, Rock Surfacing	10-24-19	1-17-20	56,081	18,568.35	$ 18,568.35	1-20-23
32	415	II-Sis-3-B	Gazelle to Yreka	17.64	Grading	8-10-23	9-13-23	236,076	67,465.62	$ 67,465.62	5-21-24
33	262	VII-SBd-Riv-26-B,A	1/3 mile N.of Co.Bdry.to Beaumont	7.10	Grading	11-13-19	2-18-20	78,979	53,527.36	$ 38,142.10	10- 5-20
33-R	458	VII-S.Bd-Riv-26-B,A	1/3 mile N.of Co.Bdry.to Beaumont		20 ft. P.C. Concrete Pavement	12-18-24	2-11-25	202,845	100,036.07	$ 100,036.07	7-24-25
34	263	VII-SD-12-E	Pine Valley to Cuyamaca Ranch	6.61	Grading	11-14-19	2-18-20	74,505	39,199.52	$ 38,324.21	4- 5-21
34-R	97704	VII-SD-12-E	3 Mi.S.E. of Pine Valley to Buckman Spr.		Grading	5- 9-28	5- 9-28	53,066	31,443.83	5,916.96	

* Final Volume Paid
+ Total Estimated Cost Based on Final Cost of Completed Projects

Project Number	Pertinent Data	Road	Location	Length Miles	Type	Plans & Est. Approved, Chief Engr.	Project Agreement Executed	Total Estimated Cost *	Amount of Federal Aid Allotment Requested	Reimbursement	Date of Completion
[illegible]	[illegible]	VII-SD-12-F	Eastern Road to Tecate Divide	14.89	Grading	11-15-27	3-12-28	$ [illegible]	$ 110,145.55	$# 110,145.70	5- 3-29
[illegible]		I-Rm-1-F	Rio Well to Potrero		Withdrawn						
[illegible]		VI-Fre-13-E	Rio Wing Bridge to Huron Road	1.00	18 ft. Concrete Pav	5-26-21	6-[illegible]-21	413,648	150,000 [illegible]	# 150,000 [illegible]	6-30-22
[illegible]		VI-Mon-18-D	Madison to Sierra Natl Forest	7.84	Grading	5-11-21	6-[illegible]-21	168,154	84,[illegible] 59	# 84,[illegible] 59	6-[illegible]-22
[illegible]		VIII-Riv-26-D	N.E Cor. Sec. 1 T.8 R.5E to St. Hwy	14.33	18 ft. Concrete Pav	8-25-20	9-[illegible]-20	416,410	179,[illegible] 70	# 179,[illegible] 70	7-30-21
40	D-[illegible]	II-Sha-26-A,B	[illegible] Mi. W. of Ingot to Montgomery Cr	4.55	Grading	6-[illegible]-21	10-[illegible]-21	135,987	47,038 15	# 47,038 15	6-23-23
41	D-[illegible]	VIII-Imp-25-D,E	Dale Wash to Easterly Boundary	14.87	18 ft. Concrete Pav	5-[illegible]-20	5-[illegible]-20	478,271	177,[illegible] 73	# 177,[illegible] 73	7- 8-21
42		II-Teh-3-D	Lake Mollinet to Red Bluff		Withdrawn						
43	D-[illegible]	VI-Mpa-18-H	El Portal to Yosemite National Park	1.28	Grading	[illegible]- 7-20	[illegible]-[illegible]-[illegible]	30,[illegible]	15,[illegible] 07	# 15,[illegible] 07	8- 1-21
44-A	268,D-[illegible]	III-Yol-7-B	Woodland to Davis	10.71	16 ft. & 18 ft. Conc.Pav	[illegible]- 7-20	[illegible]-[illegible]	282,379	140,[illegible] 80	# 134,[illegible] 36	8-15-23
44-B	M-[illegible]	III-Yol-7-A	Woodland Way to Woodland	8.33	P.C.Conc.Pav. Widening	5- 6-25	[illegible]-13-25	90,475	56,421 52	# 56,421 87	10- 2-25
45		I-Rm-20-C	Kenwood Cr. to Tenne Creeks		Withdrawn						
46		I-Rm-1-D,E	Dennville to Rio Dell		Withdrawn						
47-A	[illegible]	VI-Mpa-18-E	Sierra Navada Summit to Sycamore	5.40	Grading	[illegible]-10-27	[illegible]-7-27	251,021	121,[illegible] 03	# 121,[illegible] 03	11-[illegible]-28
47-B	D-[illegible]	VI-Mpa-18-E	Wawona to Alder Creek	3.67	Grading; 2 concrete bridges	10- 8-23	7-[illegible]-24	340,[illegible]	93,[illegible] 00	# [illegible] 577 [illegible]	10- [illegible]
48	[illegible]	IV-SCl-5-B	Southerly Boundary to Los Tanos	[illegible] 99	15 ft. Concrete Pavement	[illegible]- 7-26	[illegible]-[illegible]-26	395,[illegible]	96,[illegible] 72	# 96,[illegible] 72	12-11-27
49	[illegible]	IV-SCr-5-A	Commerce to Easterly Boundary	[illegible]	15 ft. Concrete Pavement	[illegible]- 7-26	[illegible]-[illegible]-26	[illegible]	[illegible] 07	# [illegible] 07	12-11-27
50	[illegible]	VI-Fre-10-F	Huron Road to Easterly Boundary	[illegible]	15 ft. Concrete Pavement	[illegible]-11-31	5-[illegible]-32	[illegible]	117,[illegible] 54	# 100,[illegible] 64	7-[illegible]-32
51	[illegible]	VII-SD-12-C	Flynn Springs to Aurora	[illegible]	15 ft. Concrete Pavement	[illegible]- 1-26	[illegible]-[illegible]-26	185,[illegible]	[illegible] 13	# [illegible] 13	2-[illegible]-27
52	D-[illegible] D-[illegible]	III-Men-1-B-E-F	West Ukiah to Outlet Creek	11.[illegible]	16 ft. Asph.Macadam Pavement	5- 3-26	5-[illegible]-26	290,[illegible]	145,[illegible] 91	# 145,[illegible] 87	6-[illegible]-27
53	D-[illegible]	VI-Mpa-18-F	1 Mi N of Buchanan to Clearinghouse	7.10	Grading; 2 concrete Bridges	8- 1-24	6- [illegible]-25	481,[illegible]	152,[illegible] 25	# 147,[illegible] 56	7- -27
54	D-[illegible]	VI-Mpa-18-G	Clearinghouse to El Portal	7.77	Grading; Concrete Bridge	8-27-25	3-[illegible]-26	[illegible],[illegible]	[illegible] 17	# [illegible] 77	7- -27
55	[illegible]	VII-SD-12-D	Aurora to The Willows	4.99	15 ft. Concrete Paving	[illegible]- 4-26	[illegible]- 8-26	130,[illegible]	90,[illegible] 24	# 90,[illegible] 24	6-30-27
56		II-Sha-3-A	Easterly Boundary to Redding		Withdrawn						
57		II-Teh-3-C	Red Bluff to Northerly Boundary		Withdrawn						
58-A	[illegible]	V-SD-2-E-D	Los Osmos to Saca	[illegible] 68	15 & 18 ft. Concrete Pav.	5-27-21	6-[illegible]-21	471,[illegible]	202,[illegible] 00	# 202,[illegible] 00	12- [illegible]
58-B	B-122,M-[illegible]	V-SD-2-K	Santa Barbara to Goleta	[illegible]	Asphalt Surface Treat Br.	[illegible]- [illegible]	[illegible]-27-27	108,[illegible]	[illegible] 77	# [illegible] 77	[illegible]
58-C	2[illegible]-[illegible]	V-SD-2-K	Bridge Across Devinis Creek	[illegible]	R.C.Girder or Slab & Surf	10-[illegible]-[illegible]	5- [illegible]-27	[illegible],[illegible]	[illegible] 72	# [illegible]	[illegible]
58-D	M-[illegible]	V-SD-2	At Elwood	[illegible]	Grading, Conc Br Surface	[illegible]- [illegible]	[illegible]-[illegible]-28	[illegible],[illegible]	[illegible],[illegible] 21	# [illegible] 21	6-30-27
59		V-S.L.O-35-A	From Goleta to Estrella River		Withdrawn						
60	[illegible]	[illegible]	Tioga Pass Road to Virginia Creek	[illegible]	Grading	[illegible]-11-31	[illegible]- 4-32	174,[illegible]	78,[illegible] 56	# 71,[illegible] 56	[illegible]-30
61	M-[illegible]	[illegible]	Poodvier River Bridge	[illegible]	Steel Bridge	[illegible]-13-31	[illegible]- 8-31	179,[illegible]	92,[illegible] 95	# 85,[illegible]	[illegible]-32
62		[illegible]	Underwood Canyon to Yuba City		Withdrawn.						
63		[illegible]	Westerly Entry to 1 Mi N of Leonre		Withdrawn						
64		[illegible]	Southerly Part to Owensville		Withdrawn.						
65	[illegible]	VII-Ker-[illegible]	Southerly Entry to W Lowe	[illegible] 36	18 ft. Concrete Pav	[illegible]-18-31	[illegible]-[illegible]-31	471,169	237,[illegible] 11	# 237,[illegible] 11	[illegible]-32
66	[illegible]	I-Ala-[illegible]-A	Westerly Boundary to Lowe	[illegible] 86	Grading	[illegible]- [illegible]	[illegible]- [illegible]	40,019	[illegible],[illegible] 85	# [illegible],[illegible] 85	[illegible]
67	265	A-Shc-[illegible]-A	Shas to Easterly Boundary	[illegible] 83	[illegible]	[illegible]- [illegible]	[illegible]- [illegible]	[illegible],[illegible]	[illegible],[illegible]	# [illegible],[illegible]	[illegible]
68	268-Ext [illegible]	I-Hum-1-B	Willow Cr to Last Chance Slide	[illegible] 20	[illegible] Conc Surf [illegible] Br	[illegible]- [illegible]	[illegible]- [illegible]	101,[illegible]	[illegible],[illegible] 51	# [illegible],[illegible] 51	[illegible]
69	268-B [illegible]	III-Mcv-17-A,B	Westerly Entry to Piner Valley	[illegible] 76	18 ft. Asphalt Macadam	[illegible]- [illegible]	[illegible]- [illegible]	321,479	[illegible],[illegible]	# [illegible],[illegible]	[illegible]
70	[illegible]	I-Men-15-A	[illegible] Mi. W of Ukiah to Easterly Entry	[illegible] 06	Grading, Rock Surf [illegible]	[illegible]- [illegible]	[illegible]- [illegible]	211,037	[illegible],[illegible] 37	# [illegible],[illegible] 98	[illegible]
71	[illegible]	II-Mod-22-[illegible]	[illegible] to Red Bluff	[illegible] 66	Grading, Rock Surf [illegible]	[illegible]- [illegible]	[illegible]- [illegible]	119,[illegible]	[illegible],[illegible]	# [illegible]	[illegible]
71-A	[illegible]	II-Mod-22-[illegible]	Bridge Across Mill[illegible] Creek	[illegible] 01	R.C. Girder Bridge	[illegible]- [illegible]	[illegible]- [illegible]	10,640	[illegible],[illegible] 71	# [illegible] 97	[illegible]
72-A	[illegible] 295	VII-LA-9-A	[illegible] Bridge Across [illegible] Slough	20	Concrete Bridge	[illegible]- [illegible]	[illegible]- [illegible]	165,669	[illegible],[illegible]	# [illegible]	[illegible]
72-B	M 101	VII-LA-9-A	Del Rey[illegible] to Lankershim	[illegible] 00	R.C. Slab Underpass Widening	[illegible]- [illegible]	[illegible]- [illegible]	167,356	[illegible],[illegible]	# [illegible],[illegible]	[illegible]
73	293	VI-LA-3	[illegible]	.09	Steel Bridge	[illegible]- [illegible]	[illegible]- [illegible]	67,755	[illegible],[illegible] 47	# [illegible],[illegible] 47	[illegible]
73-A	M 116	VI-LA-3	[illegible]	[illegible]	Widening Bridge; Steel Bridge	[illegible]- [illegible]	[illegible]- [illegible]	94,[illegible]	[illegible],[illegible]	# [illegible]	[illegible]
73-B	M [illegible] 85	VI-LA-3	[illegible]	[illegible] 14	[illegible] Concrete Pav. Br.	[illegible]- [illegible]	[illegible]- [illegible]	278,[illegible]	[illegible],[illegible]	# [illegible]	[illegible]
73-C	M 97	VI-LA-3	[illegible]	[illegible] 90	[illegible] Concrete Pavement	[illegible]- [illegible]	[illegible]- [illegible]	120,100	[illegible],[illegible]	# [illegible]	[illegible]
73-D	M 139	VI-LA-3	[illegible]	[illegible] 22	[illegible] Concrete Pavement	[illegible]- [illegible]	[illegible]- [illegible]	183,014	[illegible],[illegible]	# [illegible]	[illegible]

Final Voucher Filed.
* Total Estimated Cost Agrees on Final Cost of Completed Contracts.

Previous Number	Successor Number	Road	Location	Length Miles	Type	Phase A Est. Approved by Bur. Engr.	Project Agreement Executed	Total Estimated Cost *	Amount of Federal Aid Allotment or Estimate	Reimbursements	Date of Completion
74	[illegible]-D30	V [illegible] A	[illegible] Mt. Shasta Springs Station to Dunsmuir B	[illegible]	Grading, Rock Surf.	4-22-21	6- [illegible]	[illegible]	129. [illegible]	$ 12[illegible]	[illegible]
75-A	[illegible]-D32	I [illegible]	Mt. [illegible] to Redding	[illegible]	Grading, Rock Surf.	5-31-21	6-2 [illegible]	[illegible]	131. [illegible]	$ [illegible]	[illegible]
75-B	[illegible]	I [illegible]	Redding to [illegible]	[illegible]	Grading, Rock Surf.	6-26-24	10-2 [illegible]	[illegible]	118 [illegible]	$ [illegible]	[illegible]
76	289	I [illegible]	Dunsmuir to [illegible]	[illegible]	[illegible] ft. Conc. Br.	6- [illegible]-29	11-1 [illegible]	[illegible]	204. [illegible]	$ [illegible]	[illegible]
77	[illegible]-303	[illegible]	Mt. [illegible] to [illegible]	[illegible]	Grading, Rock Surf.	6-1-21	9-2 [illegible]	[illegible]	92. [illegible]	$ [illegible]	[illegible]
77-A	[illegible]-302	VI [illegible] A	Mt. Shasta Springs Station to Mt. Shasta Summit	[illegible]	Grading, Rock Surf.	4-30-22	7-1 [illegible]	[illegible]	65. [illegible]	[illegible]	[illegible]
78	310	I [illegible]	Fall River Mills to Montgomery Creek Bridge	[illegible]	Grading, Rock Surfacing	6- [illegible]-21	6-1 [illegible]	[illegible]	130. [illegible]	$ 130. [illegible]	[illegible]
79	302	I [illegible]	Montgomery Creek to Mt. Shasta Summit	[illegible]	Grading, Rock Surfacing	6-23-21	6-1 [illegible]	[illegible]	51. [illegible]	$ 50. [illegible]	[illegible]
80	[illegible]-305	[illegible]	Mt. Shasta Summit to Hemlock Gap	[illegible]	Grading, Rock Surfacing	6-21-21	[illegible]	[illegible]	116. [illegible]	$ 116. [illegible]	[illegible]
81	311	I [illegible] A	Mt. Shasta Springs to Dead Lone Valley	[illegible]	Grading, Rock Surfacing	6-13-21	1-1 [illegible]	[illegible]	152. [illegible]	$ 121. [illegible]	[illegible]
82	310	I [illegible]	Hemlock Gap to Round Valley Road	[illegible]	[illegible] ft. Conc. Bridges	8- [illegible]-21	9-2 [illegible]	[illegible]	153. [illegible]	$ 155. 776 98	[illegible]
83	309	IA [illegible]	Mt. Shasta Springs to Mt. Shasta	[illegible]	Grading	6- 7-21	9- [illegible]	[illegible]	38. [illegible]	$ 38. 776. 92	[illegible]
84	[illegible]-301	IA [illegible]	Dead Lone to Ellsworth Lane	[illegible]	Grading, Oil Treated Surf.	5-17-23	[illegible]	[illegible]	20. [illegible]	[illegible]	[illegible]
85	[illegible]-331	IA [illegible]	Ellsworth Lane to Cantara	[illegible]	Grading, Rock Surfacing	5-30-23	[illegible]	[illegible]	20. [illegible]	[illegible]	[illegible]
86	328	IA [illegible]	Cantara to [illegible]	[illegible]	[illegible] ft. Br. [illegible] Mountain	10- 5-21	[illegible]	[illegible]	185. [illegible]	$ 165 592.03	10-1 [illegible]
87	[illegible]-329	I [illegible] A	Mt. Shasta Summit to Weed-Montgomery Creek Road	[illegible]	Grading, Rock Surfacing	10-25-21	[illegible]	[illegible]	160. [illegible]	$ 105,870.15	8-2 [illegible]
87		IA [illegible]	Mt. Shasta Summit to Sisson		Withdrawn						
88	320	IA [illegible]	Sisson to Shasta Valley	[illegible]	Grading, Rock Surfacing	12-22-21	[illegible]	[illegible]	148. [illegible]	$ 148. [illegible]	10- 8-24
89	319	I [illegible]	Montague to Grenada	[illegible]	Grading, Rock Surfacing	12-22-21	[illegible]	[illegible]	73. [illegible]	$ 63 090.29	10- 8-24
90	315	I [illegible] A	Grenada to Edgewood	[illegible]	Grading, Rock Surfacing	4-30-22	[illegible]	[illegible]	25. [illegible]	$ 25 431.92	10- 8-24
91	322	I [illegible]	Edgewood to Buckeye Creek	[illegible]	Grading, Rock Surfacing	2-23-22	[illegible]	[illegible]	116. [illegible]	$ 116,685.95	7- 6-24
92	[illegible]-326	III [illegible]	Whitewater to Edna	[illegible]	16 ft. Concrete Pav. Conc. Br.	2-27-22	[illegible]	[illegible]	408. [illegible]	$ 369,011.82	5-21-24
92-A	W 126	III [illegible]	Whitewater to Edna	[illegible]	Concrete Pav. Widening	6- 7-26	[illegible]	[illegible]	113. [illegible]	$ 65,281.12	10- [illegible]
93-A	W 96	III [illegible]	Edna to Indio	[illegible]	R.C.C. Pav. Bypass, Conc. Bridges	5-15-25	[illegible]	[illegible]	153. [illegible]	$ 87,021.52	9-[illegible]
93	W 135	III [illegible] F	Indio to Mi. [illegible] of Coachella	[illegible]	R.C.C. Pav. Bypass, Asph. Conc. Surf.	6- 2-26	[illegible]	[illegible]	198. [illegible]	$ 117, 378.21	5-1 [illegible]
94	367	VI [illegible]	Three Rivers to Sequoia Natl. Park	[illegible]	Grading	5-23-22	[illegible]	[illegible]	168. [illegible]	$ 94, 386.55	1-2 [illegible]
95	357	V [illegible]	San Luis to [illegible] Mi. E. Long Valley	[illegible]	Grading, Rock Surfacing	5- 3-22	7-14 [illegible]	[illegible]	177. [illegible]	$ 90, [illegible]	9-1 [illegible]
96	372	VI [illegible]	Los Banos to San Luis Creek	[illegible]	16 ft. Concrete Bridges	6-14-22	11- [illegible]	[illegible]	404. [illegible]	$ 232, 992.75	12-1 [illegible]
97	361	IV [illegible]	Westerly Bdry. to Upper Lake	[illegible]	Grading, Rock Surfacing	5- 1-22	[illegible]	[illegible]	198. [illegible]	$ 116, 578.74	9- [illegible]
98	328	III [illegible]	Banning to Whitewater	[illegible]	16 ft. Concrete Pav.	4-25-22	[illegible]	[illegible]	272. [illegible]	$ 159, 666.98	9- [illegible]
98-A	404	III [illegible]	Across San Gorgonio Wash	[illegible]	Conc. Br. & Conc. Appr. Pav.	5-30-25	[illegible]	[illegible]	17. [illegible]	$ 9, 851.32	9- [illegible]
99	360	V [illegible]	Quosta Grade	[illegible]	2 ft. Concrete Pav.	5- 1-22	[illegible]	[illegible]	183. [illegible]	$ 84, 471.21	1- [illegible]
100	371	VI [illegible] A	Westerly Bdry. to Mt. Lule Grove	[illegible]	2 ½ Conc. & 12 ft. Conc.	6-15-22	[illegible]	[illegible]	181. [illegible]	$ 105, 881.31	1- [illegible]
101	429	IV [illegible] A, B	Smooth Rd. to Cliff Mt. Bay Road	[illegible]	Grad. Rock Surf. Conc. Bridges	9-20-22	[illegible]	[illegible]	268. [illegible]	$ 262, 572.87	1-2 [illegible]
102	373	II [illegible] A, B	Upton to Arnold Ranch	[illegible]	12 ft. Concrete Pav.	5- 6-22	[illegible]	[illegible]	316. [illegible]	$ 187, 239.93	11-1 [illegible]
103-A	381	II [illegible] A, B, F	Auburn to Grass Valley Road	[illegible]	12 ft. Bituminous Macadam	3- 7-22	[illegible]	[illegible]	390. [illegible]	$ 220, 002.66	1-2 [illegible]
103-A	[illegible]-[illegible]-[illegible]	II [illegible] A, F	Auburn to 1/4 Mi. North of Colfax	[illegible]	Fire Grade Separations	[illegible]	[illegible]	147, [illegible]	24, [illegible]	16, 201.80	
104-A	377	I [illegible]	Susanville to Honeybucket Lassen	[illegible]	Grading, Rock Surfacing	10-23-22	[illegible]	[illegible]	319. [illegible]	$ 319, [illegible]	10- [illegible]
104-B	382	I [illegible]	Almond Way Lassen	[illegible]	Grading, Surf. Treated Found.	1- [illegible]	[illegible]	[illegible]	82. [illegible]	$ 91, 155.21	9-26 [illegible]
105	[illegible]-453	VI [illegible] F	Sycamore Cr. to the King River Hwy	[illegible]	Grading, Concrete Bridges	[illegible]	[illegible]	458, [illegible]	180, [illegible]	$ 180, 303.04	7-11 [illegible]
106		II [illegible] A	Auburn-Lake to Emerson Ave		Withdrawn						
107	[illegible]-[illegible]-427	II [illegible] A	1 M. E. of Truckee to 1 M. E. of Westgate	[illegible]	Grading, Rock Surf. Conc. Bridges	9- [illegible]	1-10-23	250. [illegible]	147, [illegible]	124, 655.32	
108	429	VI [illegible]	Westgate Junction to Copperopolis	[illegible]	Grading	12-10-22	[illegible]	129. [illegible]	74, [illegible]	$ 74, 688.66	1-21-24
109	435	IV [illegible] A	Mt. View to San Pedro	[illegible]	Grading, Rock Surfacing	4-30-23	[illegible]	104. [illegible]	57, [illegible]	$ 57, 689.32	1- [illegible]
110		III [illegible]	Riverside City to Little Bear Creek		Withdrawn						
111	[illegible] Ext	II [illegible]	[illegible] Mi. S. Placerville to Oregon Line	[illegible]	Grading, Rock Surfacing	10-20-23	[illegible]	485. [illegible]	208, [illegible]	$ 208, 765 99	[illegible]
112		VI [illegible] A	Mariposa Boundary to Califa		Rejected						
113		III [illegible]	Tehachapi Summit to Donner Lake		Rejected						
114		II [illegible]	Sacramento to Fresno		Rejected						
115		III [illegible] A, B	Whittier to 1 Mi. S. of Olive		Rejected						
116	[illegible]-[illegible]-[illegible]	VI [illegible] A	Mariposa Boundary to Wilson Creek	[illegible]	Grading, Rock Surf.	6-17-22	7-10-22	[illegible], [illegible]	353, [illegible]	226, 173 57	

* Engr. Counter Basis
† Estimated Cost Based on Final Cost of Completed Projects

RECORD OF FEDERAL AID PROJECTS, JUNE 30, 1928—Continued

Project Number	Contract Number	Road	Location	Length Miles	Type	Plans & Est. Approved by Dist. Engr.	Project Agreement Executed	Total Estimated Cost *	Amount of Federal Aid Allocated or Requested	Disbursements	Date of Completion
117		VII-Ven-A	1/2 M. S E Avenue Rd. to Rincon Ranch		Withdrawn						
118-A		[illegible]	Fernando to Sylmar	2.06	Grading, Rock Surf.	11-20-26	5-13-27	$ 98,663	$ 37,146.93	$ 37,145.12	12-15-27
119	[illegible]	VII-[illegible]	Wolfy Bch. Yuma Dist Boundary to Yuma River	8.02	Grading, Rock Surf. Timber Br.	2-16-24	10- 4-24	223,292	157,472.19	155,336.47	4-15-25
120	[illegible]	VII-Ker-[illegible]	14th Ave. Kern R. to Bakersfield Stirings	8.36	Grading	7- 1-24	4- 4-25	482,217	148,773.72	148,293.23	1- 6-26
121	4-A	VII-LA-[illegible]	Fish Canyon Road to Azusa	.97	24 ft. Concrete Pav.	5-30-25	6-25-25	45,275	23,016.03	23,016.03	11-26-25
121-B	9770[illegible]	VII-LA-9-C	Between Monrovia and Azusa	1.68	40 ft. Asph. Conc. Pav.	5- 8-28	6-30-28	77,192	30,355.27		
121-C	9417[illegible]	VII-LA-9-K	Santa Anita Creek Bridge	.04	R. C. Girder Bridge	11-14-28	8-22-28	27,127	16,276.42		
122	430	1-Mno-1-F	Bridge over Van Duzen River	.14	R. C. Arch Bridge	3-14-24	8-11-24	111,481	66,865.33	$ 65,937.81	5- 4-25
123	433	IV-Bon-5[illegible]-B	Baltimore to Sweetwater	Mi.50	7.23 Grad. & 27.20 Ft. Paving	5-31-23	6-27-25	328,629	130,639.46	$ 120,434.46	12-13-24
124	D-[illegible] D-681	I-Tri-9-B	Yosemite Long Gulch to Easterly Bdry.	6.49	Grading	6-28-23	1-10-24	153,025	142,840.45	60,189.86	
125-A	M-25	IV-SM-2-A	San Bruno to San Mateo	3.37	Conc. Pav. Widen. Asph. Conc. Surf.	6-28-23	10-17-23	229,140	79,962.92	$ 79,962.92	2-20-24
125-B	M-78	IV-SM-2-A	Cemeteries to San Bruno	4.35	Conc. Pav. Widen. Asph. Conc. Surf.	8-15-25	6-26-25	242,362	85,637.30	$ 82,748.90	3-17-26
125-C	M-148	IV-SM-2-A	Colma to Cypress Lawn Cemetery	1.51	Grading	9- 7-26	2-21-27	142,073	27,238.68	$ 27,238.68	6-20-27
126-A	[illegible] D-593	V-Mon-1-F	San Lorenzo River Bridge	.34	Concrete Bridge, Pav. Appr.	1-12-26	3-31-26	46,423	23,818.93	$ 23,818.93	5-30-27
126-B	M-37	V-Mon-2-C	San Ardo to San Lorna	10.24	Rock Borders	6- 6-25	10-20-25	31,789	19,084.10	$ 17,815.32	8-21-25
127-A	M-26	[illegible]-Pla-1-A	At Whitney	1.06	2nd Story Conc. & Conc. Pav. Widen.	7-28-23	10-24-23	37,182	23,236.34	$ 21,580.85	12-10-23
127-B	489	[illegible]-Pla-1-A	Across Auburn Ravine	.04	Concrete Bridge	5- 3-26	8- 5-26	17,811	9,675.99	$ 9,675.99	10-30-26
127-C	93802	[illegible]-Pla-1-A	Southerly Boundary to Roseville	1.02	20' Asphalt Concrete Pav.	7-26-27	12-27-27	34,186	18,447.36	18,447.36	4- 2-28
128	M-25 Ext	IV-SM-[illegible]	San Mateo to [illegible]ard	1.76	Conc. Shlds. Asph. Conc. Pav. Widen.	11-10-23	2-18-24	101,255	41,737.32	41,191.58	2-20-24
129	457	IV-SCl-[illegible]-B	Bridge over Cedar Creek	.02	Concrete Bridge	1-16-24	3-27-24	17,662	9,146.74	8,882.98	10-25-24
130-A	M-53	VI-Ven-1-F, G	Seacliff to [illegible] El Rincon	1.31	Sea Wall and Grading	5-10-24	3-21-27	449,062	270,098.71	$ 262,197.42	10-12-26
130-B	M-151	VI-Ven-[illegible]-D, E, F	Ventura to Seacliff	8.34	20 ft. Concrete Pavement	10- 4-26	6-23-27	420,410	150,245.10	$ 150,245.10	10-22-27
130-C	M-72	V-SB-[illegible]-[illegible]	Ortega Hill to Santa Barbara	1.86	Asph. Conc. Pav. P. C. Conc Pav. Widen.	1- 2-25	6-26-25	92,483	35,849.84	$ 35,849.84	12-30-25
130-D	K-103	V-SB-[illegible]-[illegible]	Summerland to Montecito	1.42	Grading Surfacing	10-10-25	12-31-25	74,864	25,581.30	$ 25,581.30	6-28-26
130-E	K-109	V-SB-[illegible]-H	Carpinteria to [illegible]ales South	2.04	20 & 30 ft. Asphalt Conc. Pav.	11-10-25	4-10-26	61,753	32,803.66	$ 32,803.66	6-28-26
130-F	M-142	V-SB-[illegible]-B, J	Carpinteria to Summerland	4.48	30 ft Conc. Pavement	9- 1-26	2-10-27	302,043	92,350.05	$ 91,943.71	2- 1-28
131-A	[illegible]-[illegible]	VII-Imp-[illegible]-C	El Centro to [illegible]	8.97	Grading; Rock Surf. Timber Br.	6-22-25	10-19-25	146,903	90,887.50	$ 82,628.26	7-30-26
131-B	[illegible]-[illegible]	VII-Imp-[illegible]-D	Holtville to E. Highline Canal	6.94	Grading; Rock Surf. Timber Br.	8- 1-25	10-19-25	121,991	77,067.82	$ 72,416.77	7-30-26
131-C	491	VII-Imp-[illegible]-B	Through Sand Hills	6.45	20 ft. Asphalt Conc. Pav.	12-15-26	2-21-34	329,101	116,196.75	$ 116,196.75	11-29-26
132	474	III-Mer-Sis-M-B, A	Florisdon to Mex. State Line	5.96	Grading	6- 1-25	8-22-25	272,806	107,369.40	$ 107,369.40	6- 8-26
133-A	[illegible]-[illegible]-71	III-Mer-3[illegible]-A	Tranbee to Boca	7.31	Grading; 3 Concrete Bridges	12-20-23	10-22-24	235,151	140,253.81	$ 134,822.47	6- 8-26
133-B	[illegible]-[illegible]-C	III-Mer-3[illegible]-B	Boca to Floriston	5.80	Grading; 2 Concrete Bridges	6-10-24	9-30-24	349,573	137,046.92	$ 133,788.26	8-14-26
134	4-A	III-Teh-5-D	Los Molinos to Red Bluff	.28	6 Conc. Bridges & Appro.	11-14-23	2-23-24	50,054	31,571.08	$ 29,085.84	12-13-24
135		III-Teh-Sha-[illegible]-E, A	Shasta to Cottonwood Dr.		No work done						
136-A	M-[illegible]-[illegible]-[illegible]-[illegible]	VII-SD-[illegible]-A, B	San Diego to Oceanside	16.79	Pav. Widen. 2nd Story Conc. Br.	12-18-23	4- 9-24	698,114	386,417.51	$ 378,583.42	1- 3-28
136-B	M-53, 54A, [illegible]	VII-[illegible]-C	2 Mi. S. of San Onofre to Elv. Bdry.	3.77	20' Conc. Pav; 2 Conc. Bridges	4-15-25	11- 5-25	266,092	153,682.66	$ 146,971.05	3-17-26
136-C	M-53	VII-[illegible]-D	Oceanside to 2 Mi. S. of San Onofre	10.88	Pav. Widen. & 2nd Story Conc.	7-30-25	10- 6-25	583,900	281,467.35	$ 281,467.35	8-11-26
137	[illegible]	VII-Imp-[illegible]-A	Brawley to Imperial	5.93	Grad., Rock Surfacing	11-24-23	3- 5-24	51,388	24,662.00	$ 24,662.00	6-11-24
138-A	439 & Ext.	V-SM-[illegible]-C	Half Moon Bay Rd. to La Honda Rd.	12.35	Grad., Rock Surfacing	2- 1-24	6-18-24	607,892	238,287.08	$ 238,075.01	11-13-25
138-B	[illegible]-[illegible]-51	I-Sis-[illegible]-SCr-15-D, E, A	La Honda Road to Saratoga Gap	11.83	Grading, Rock Surfacing	4- 7-26	7-15-26	690,221	249,111.42		
139	4-A	V-Sis-[illegible]-A	Easterly Bdry to Turner Station	11.55	20 ft. Conc. Pav. P. C. Conc. Pav. Widen.	3-10-25	6-17-25	309,178	170,633.10	$ 161,522.04	12-30-25
140	[illegible]	11-Sha-1-B	Redding to Shasta	3.53	20 ft. Concrete Pav.	12- 1-23	5- 8-24	479,186	235,817.74	$ 235,822.63	10-25-24
141-A	[illegible]	11-Sha-[illegible]-C	Keswick to [illegible] Creek	9.91	Grad., Rock Surf.	12-18-23	[illegible]-24	595,803	237,515.97	$ 235,048.28	4- 6-25
141-B	[illegible]-[illegible]-[illegible]	11-Sha-[illegible]-C	[illegible]ew Dr. to Bo. Creek	11.04	Grad., Rock Surf. & Conc. Bridges	11-14-24	[illegible]-25	668,271	307,698.30	$ 300,568.17	2- 7-27
141-C	[illegible]-[illegible]-[illegible]	11-Sha-[illegible]-C	Bo. Creek to La Moine	4.58	Grad., Rock Surf., Conc. Bridges	F. 8-26	[illegible]-27	460,198	168,085.75	$ 165,914.55	1- 3-28
141-D	[illegible]	[illegible]-Sha-1-D	Lassina to Shotgun Creek	1.80	Grad. Rock Surf. & arch culverts, 2 Brs	5-23-27	1-10-28	410,381	180,603.60	131,328.89	
141-E	[illegible]	[illegible]-Sha-[illegible]-C	Shotgun Dr. to Northerly Boundary	12.06	Grad., Rock Surf.	3-30-28		592,790	217,170.82		
142-A	[illegible]	I-Sis-[illegible]-A	Southerly Boundary to Weed	1.89	20 ft. Concrete Pav.	1- 3-24	[illegible]-24	77,471	36,437.10	$ 36,437.10	5-21-24
142-B	M-99 Ext.	I-Sis-[illegible]-B	Weed Elk Creek to McCloud Sta.	1.99	20 ft. Concrete Pav.	6- 9-24	[illegible]-24	130,488	77,115.56	$ 76,842.01	9-22-24
142-C	[illegible]	I-Sis-[illegible]-A	Weed to Ager	5.82	Grad., Rock Surf. & Conc. Bridges	7- 9-27	[illegible]-27	111,932	63,632.71	14,014.50	

* Bond Premium Paid
* Bond Redemption Cost Shown on Final Cost of Completed Projects

Project Number	Contract Number	Road	Location	Length Miles	Type	Plans & Est Approved by Dist. Engr.	Project Agreement Executed	Total Estimated Cost +	Amount of Federal Aid Allotted or Requested	Reimbursements	Date of Completion
143	M- 30	VII-LA-2-B,C	Sherman Blvd to Russel Ramon	14.73	Conc.Pav.Widen.& 2nd Story Conc	1- 2-24	6-22-24	$ 432,497	$ 224,127.06	$# 223,531.96	10- 1-24
144-A	M- 41	IV-SCl-5-A	Milpitas to Coyote Creek	3.72	Asphalt Concrete Surface	2-25-24	5-29-24	95,250	56,312.45	# 50,043.74	8- 1-24
144-B	94E23	IV-Ala-SCl-5-C-A	Ware Sprtsmn Junction to Milpitas	3.41	Grad.,Conc.Pav.Widen.A.C Surf	8-20-27	12-27-27	156,860	61,931.15	53,830.47	4-21-28
145-A	M- 90	IV-Son-1-B	Healdsburg to Santa Rosa	8.84	Pav.Widen., 2nd Story Conc.	6-10-25	10- 9-25	323,077	151,565.93	# 151,565.93	9-1-26
145-B	M-102	IV-Son-1-C	Across Willow Brook	01	Concrete Bridge	7-15-25	2-15-26	19,176	11,878.35	# 11,139.85	5-15-26
145-C	510	IV-Son-1-A	Through Cloverdale	1.33	20' Concrete Pavement	7- 1-26	10- 7-26	55,148	23,887.89	# 23,887.89	12-15-26
145-D	94E27	IV-Mrn-1-A	Ignacio to San Rafael	4.93	Grad. 20 ft. Conc.Pav	5-10-28		237,506	96,888.80		
146-A	M- 49	IV-SM-2-B	Redwood City to Southerly Bdry	3.46	Asph Conc. Surface	4-26-24	8-11-24	132,274	61,573.81	# 61,573.81	2- 2-25
147-A	M- 44	X-Sol-7-D	Vacaville to Batavia	8.29	(.38 Mi.2nd Story Concrete (7.91 Mi.Asph.Conc.Surf.& Widen.	8- 7-24	9-13-24	258,599	140,587.99	# 140,587.99	1-14-25
147-B	M- 62	X-Yol-6-7-A	Southerly Bdry to Davis	4.47	P C. Conc. Pavement Widening	3- 5-25	8-15-25	69,890	42,073.00	# 40,028.59	10- 1-26
147-C	M- 91	X-Sol-7-B	Rockville to Fairfield	3.96	Concrete Pav. Widen.	6- 5-24	9-29-24	50,966	27,548.76	# 27,548.76	12-13-24
148-A	M- 52	IV-Ala-5-A	Greenville to Livermore	4.33	Concrete Pav. Widen.	5-12-24	8-11-24	55,094	33,142.66	# 30,095.64	10-27-24
148-B	M-co,M-158,911E25	X-SJ-5-B	Moraddle to French Camp	6.98	20' Conc.Pav.,2 Bridges, subway	3- 7-25	6-15-25	524,062	288,344.81	134,861.43	
148-C	M- 56	X-SJ-5-A	Westerly Bdry. to South	8.07	20' Asphalt Conc. Pave.	6- 5-24	9-22-24	217,514	112,593.45	# 108,043.82	1- 3-25
148-D	M-142,911E31	IV-Ala-5-B	Livermore to Dublin	9.07	Grade.,Conc.Pav. 3 Conc. Bridges	4-22-27	10-20-27	380,408	176,303.13	# 176,179.86	1-17-28
148-E	94E22, 911E011	IV-Ala-5-B	Dublin to Castro Valley Road	3.89	Grade.Bit.Mac.Pav. Culverts	7-14-27		386,710	136,008.26		
149-A	M- 47	IV-SC-14-A	Guerrity Creek Bridge	.01	Concrete Bridge	5- 6-24	8-22-24	5,806	2,495.40	# 2,419.31	10-25-24
149-B	M- 75	IV-SC-14-A,B	San Pablo Dr. to El Ciervo	6.63	Bituminous Macadam Surf.	4- 6-25	10-19-25	166,523	101,982.04	# 99,870.29	12-31-26
149-C	M-117	IV-SC-14-A	Across San Pablo Cr	.02	Concrete Bridge	3-29-25	6-14-26	22,459	13,629.00	# 13,078.35	11-15-26
149-D	M-149	IV-SC-14-B	El Ciervo to Valona	1.78	Grading and Rock Surfacing	7-21-26	9-10-27	225,419	30,103.06	# 30,103.06	9-29-27
149-E	911E34, 94B05	IV-SC-14-A	Across Wildcat Creek	.26	Conc.Bridge,Grade.& Surf.Appr	6-10-27	9-17-27	25,459	12,544.88	7,381.32	4- 1-28
150-A	4A12	III-Pla-37-C	3/4 Mi.N.of Colfax to Gold Run	8.03	Grading	5- 3-24	7-29-24	370,064	142,686.43	# 142,231.95	11-30-25
151-A	465, 488	VIII-Imp-Ch-F,G	Imperial to Brawley	9.43	Grading,Surfacing,Timber Br.	4- 5-25	5-10-25	123,763	69,840.80	# 69,729.12	2-21-27
151-B	502, 503	VIII-Imp-Ch-B	Brawley to Westmoreland	6.52	Grading,Surf., 3 Timber Br.	6- 5-26	11- 3-26	135,616	75,892.47	# 73,788.76	6- 1-27
152-A	M- 64	VI-Mer-4-C,D	Merced River to 1-1/2 Mi.S.of Atwater	6.54	2nd Story P.C.Conc.Pav.Widening	3- 7-25	5-21-25	172,951	101,194.11	# 101,194.11	11-30-25
152-B	M-181	VI-Mer-4-A	Merced to Athlone	9.78	20' Conc.Pav. Widen. A.C. Surf.	7-25-26	3- 7-27	182,868	102,843.75	# 102,843.75	7-22-27
152-C	M-161	VI-Mer-4-A	Athlone to Southerly Boundary	4.51	20' Pav Widen.A.C Surf.	2- 7-27	5- 6-27	87,886	62,014.26	# 58,105.73	8-14-27
153-A	M- 81	III-ED-11-E,F	Camino to 2 Mi.E. of Sportsman's Hall	5.77	Grading Rock Surfacing	5- 6-25	7-30-25	74,498	44,508.14	# 43,594.34	1-16-26
153-B	M-127	III-ED-11-F	2 Mi.N.of Sportsman's Hall to Riverton	2.59	Grading Rock Surfacing	4-30-26	8-16-26	45,267	28,929.52	# 27,159.90	1-24-27
154-A	456	III-Col-15-E	Freshwater Cr. to Williams	7.41	Grading Rock Surfacing	9- 2-24	12- 3-24	84,581	41,616.13	# 39,121.98	10- 1-25
154-B	531, D-621	III-Lak-15-C	Sweet Hollow Summit to Easterly Bdry.	12.04	Grading-Conc. Bridge	7- 1-26	11- 3-26	370,822	222,830.94	# 85,659.85	
155-A	452, 500	III-Lak-28-A	Bieber to 4 Mi. West	4.04	Grading, Surf.7 Timber & Conc.Brs.	9- 8-24	3-10-25	126,569	78,960.75	# 70,667.38	11- 9-26
156-A	D-582, 457, 530	I-DN-1-C	Elk Valley Road to Adams Station	13.11	Grading, Bridges	9-29-24	5-15-25	960,192	361,836.67	220,051.48	
157-A	M-67, M-68, M-88	III-Sac-3-B	American Riv. to Globe Iron Works	.65	30 ft.P C.Conc.Pav; 2 Underpasses	6- 1-25	7-30-25	92,295	51,717.32	# 43,063.25	2-25-26
157-B	M-167, 93E24	III-Sac-3-B	Ben Ali Subway and Approaches	.45	30 ft. Conc.Paving	3-18-27	9-26-27	98,755	37,321.84	# 35,310.02	2- 1-28
157-C	93E02	III-Sac-3-B,A	Sylvan School to Northerly Boundary	2.04	20 ft. Asphalt Conc. Surf.	8- 8-27	12-22-27	65,255	37,962.46	# 37,962.46	4- 2-28
157-D	911E26	III-Sac-3-B	Across Arcade Creek	.21	3 Conc. Bridges	7-21-27	11-16-27	37,620	21,841.05	# 21,760.26	1-21-28
158-A	480, 493	X-Yol-4-C	W.Sacramento to W St. Bridge	.56	Grading; Underpass	8-15-25	1-16-26	42,611	24,162.90	# 23,221.18	6- 8-26
159-A	M-86, M-125	V-Mon-2-H,I	1 Mi.N.of Bradley to San Ardo	11.73	Rock Borders,2 Conc.Brs; Culvert	5-19-25	10-20-25	117,538	66,887.96	# 63,339.57	5-11-27
160-A	M- 69	VI-Fre-1-C	2 Mi.N.of Fresno to Herndon	5.94	P.C.Conc.Pav. Widening	3-23-25	7-10-25	56,824	34,399.72	# 33,668.88	10- 4-25
160-B	M-130	VI-Mad-1-A	Madera to Borden	2.09	P.C.Conc.Pav. Widening	4- 1-26	6-29-26	20,404	12,365.10	# 11,893.28	9-14-26
160-C	96B02	VI-Mad-1-A	Tesora to 1 Mi.S.E. of Borden	6.48	20 ft. Asph.Conc.Surf.	3- 8-28	4-27-28	121,362	79,702.52		
160-D	911T04	VI-Fre-Mad-1-C,A	Across San Joaquin River	.17	Steel Bridge	3-23-28		207,608	124,564.84		
161-A	M- 82	VI-Ker-4-D	Beardsley Canal to Lerdo	8.21	Asphalt Conc.Surf. & Widening	5- 4-25	7-10-25	168,176	98,230.02	# 95,777.50	3-17-26
161-B	M-112	VI-Ker-4-F	1 Mi.S.of Delano to 1.8 Mi.South	.75	Asphalt Conc.Surf. & Widening	12- 5-25	1-24-26	14,175	9,759.42	# 8,376.07	2- 8-26
161-C	M-123	VI-Ker-4-F	1 Mi.S.of Delano to Northerly Bdry	2.77	Asphalt Conc.Surf. & Widening	4-19-26	8- 7-26	61,244	36,271.12	# 36,271.12	9-28-26
161-D	96F02	VI-Ker-4-F	2 Mi. South of Delano to 1 Mi.N.of Famosa	8.63	20 ft. Asph.Conc. Surf.	7-21-27	10-20-27	183,819	113,873.43	# 107,052.60	2- 8-28
161-E	96F01	VI-Ker-4-E	Lerdo to 1 Mi. North of Famosa	9.06	20 ft. Asph.Conc. Surf.	7-20-27	11- 8-27	207,737	127,220.59	# 120,434.81	2-27-28
162-A	M- 77	I-Men-1-J	Leggett Valley to 2 Mi.N.of Rock Creek	6.14	Grading; Rock Surfacing	4-20-25	9-12-25	263,784	110,693.16	# 110,693.16	10- 1-26

Final Voucher Paid
+ Total Estimated Cost Based on Final Cost of Completed Projects

RECORD OF FEDERAL AID PROJECTS, JUNE 30, 1928—Continued

Project Number	Federal Number	Road	Location	Length Miles	Type	Plans & Est. Approved by Bur. Engr.	Project Agreement Executed	Total Estimated Cost *	Amount of Federal Aid Allotted to Project	Expenditures	Date of Completion
67-A	M- [illegible]	[illegible]	[illegible] Redlands	[illegible]	[illegible]	5-[illegible]	[illegible]	$ [illegible]	$ [illegible]	$ [illegible]	[illegible]
67-B	93701	[illegible]	[illegible] N.of [illegible]raide to Line	[illegible]	26 ft. [illegible] Surfacing	[illegible]	[illegible]	[illegible]72	[illegible]	[illegible]	[illegible]
67-C	911502	[illegible]	[illegible] ino & Burlando	[illegible]	3 Con[illegible]	[illegible]	[illegible]	[illegible]82	[illegible]	[illegible]	[illegible]
67-D	M-[illegible]	[illegible]	[illegible]	[illegible]	20 ft. [illegible] Paving	[illegible]	[illegible]	[illegible]35	[illegible]	[illegible]	[illegible]
67-E	503	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33,[illegible]	[illegible]	[illegible]	[illegible]
68-A	[illegible]	[illegible]	[illegible]	74	Grading, [illegible] Surfacing	7-3-[illegible]	[illegible]	174,[illegible]	[illegible]	[illegible]	[illegible]
68-B	[illegible]	[illegible]	[illegible]	66	Grading, [illegible] Surfacing	[illegible]	[illegible]	380,[illegible]	[illegible]	[illegible]	[illegible]
68-A	[illegible]	[illegible]	[illegible] Grade to Stony Creek	80	Grading [illegible] Surfacing	[illegible]	[illegible]	38[illegible]	[illegible]	[illegible]	[illegible]
68-B	93701	[illegible]	[illegible] Mi.N. of Santa Rosa	11	Grading	[illegible]	[illegible]	58,[illegible]	[illegible]	[illegible]	[illegible]
68-C	93702	[illegible]	[illegible] to Santa Rosa	23	20' Asphaltic Conc. Surf.	[illegible]	[illegible]	168,[illegible]	[illegible]	[illegible]	[illegible]
69	[illegible]	[illegible]	[illegible] Line to Clear Lake	[illegible]	Withdrawn	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
69-A	M-[illegible]	[illegible]	[illegible] Crescent	57	Grading, [illegible] Surfacing	[illegible]	4-17-[illegible]	71,[illegible]	[illegible]	[illegible]	[illegible]
70-A	M-115	[illegible]	[illegible] Crossing	1.04	2nd Story R.C. Concrete	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
71-A	M-119	[illegible]	[illegible]	70	Grading; [illegible] Surf.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible] Laguna River	77	P.C.Conc.Pav., [illegible]an.Asph Conc. Surf.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
72-A	M-163	[illegible]	[illegible]	69	20 ft. Concrete Paving	[illegible]	6-3-[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
74-A	911829	[illegible]	[illegible] & Stone Storm Drain	13	2 Concrete [illegible]ngo	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
75-A	911808	[illegible]	[illegible]	07	Concrete [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
75-B	93701	[illegible]	[illegible]	09	Grading [illegible] Conc.Paving	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
76-A	1832, 910801	[illegible]	[illegible] to Tehama Station	38	Grad. and [illegible] Surf., [illegible] Bridge	[illegible]	10-21-[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
77-A	95802	[illegible]	[illegible] & Santa Rita Road	86	20 ft. Conc. Paving	[illegible]	12-31-[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
51-A	94702	[illegible]	[illegible] Belmont to San Mateo	00	Grading and Rock Surf.	[illegible]	[illegible]	[illegible]333.[illegible]	[illegible]	[illegible]	[illegible]
8-A	18815	[illegible]	[illegible]	56	Subway	[illegible]	[illegible]	[illegible]148.[illegible]	[illegible]	[illegible]	[illegible]
31-A	93703	[illegible]	[illegible] to San Buenaventura	27	30 ft.Asphaltic Conc.Paving	[illegible]	12-30-[illegible]	[illegible]654.[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$ [illegible]	$[illegible]	$[illegible]	[illegible]

* [illegible] Engineer's [illegible]
[illegible] Average of Low Bidders on Equal Basis of Comparative Specifications

APPORTIONMENT OF MOTOR VEHICLE LICENSE FEES AND GAS TAX

(a) Yearly Registration of Motor Vehicles in California.

(b) County Apportionment of Motor Vehicle Fees, January 1, 1914, to January 31, 1924, inclusive.

(c) County Apportionment of Motor Vehicle Fees, February 1, 1924, to June 30, 1928, inclusive.

(d) County Apportionment of Motor Vehicle Fuel Tax, October 1, 1923, to September 30, 1928.

(e) Apportionment of Motor Vehicle Fees, July 1, 1926, to December 31, 1926.

(f) Apportionment of Motor Vehicle Fees, January 1, 1927, to June 30, 1927.

(g) Apportionment of Motor Vehicle Fees, July 1, 1927, to December 31, 1927.

(h) Apportionment of Motor Vehicle Fees, January 1, 1928, to June 30, 1928.

(i) Apportionment of Motor Vehicle Fuel Tax, October 1, 1926, to September 30, 1927.

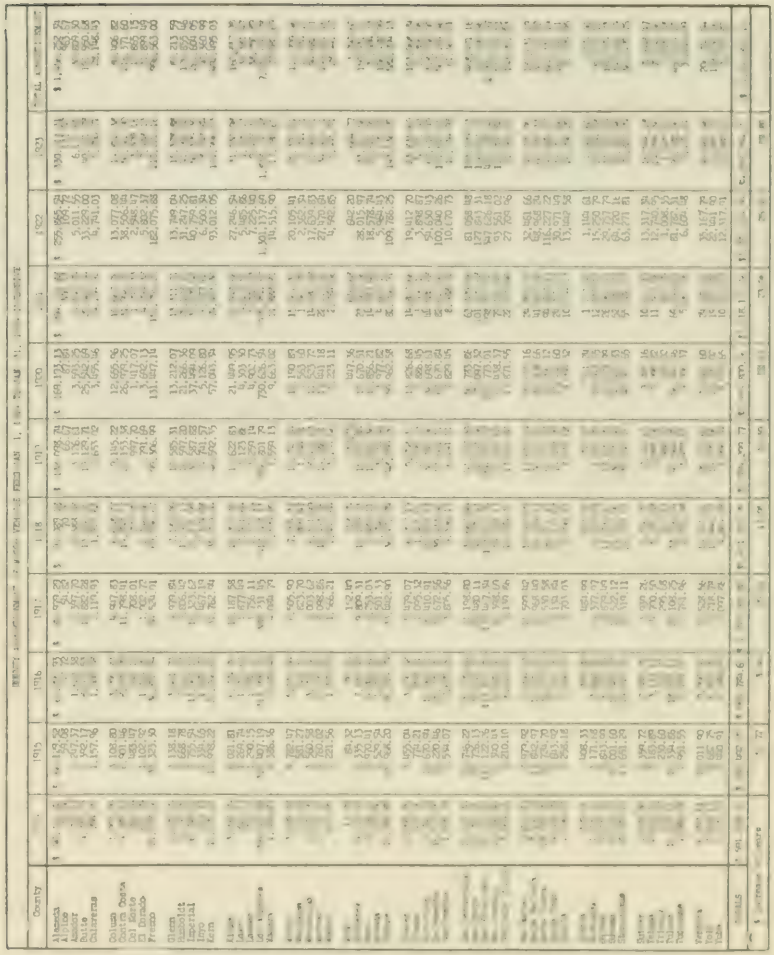
(j) Apportionment of Motor Vehicle Fuel Tax, October 1, 1927, to September 30, 1928.

(k) Stage Line Franchise Tax Apportioned to June 30, 1928.

STATEMENT OF REGISTRATION BY YEARS, OF MOTOR VEHICLES IN THE STATE OF CALIFORNIA FROM THE RECORDS OF THE DIVISION OF MOTOR VEHICLES

	Autos and trucks (including exemptions)		*Per cent increase over previous year*	*Trailers*	*Motor-cycles*	*Non-residents*	*Dealers*
	Total	*Yearly increase*					
Previous to 1907	10,020						
1907	14,051	4,031	40.2				
1908	19,561	5,510	39.2				
1909	28,633	9,072	46.3				
1910	44,122	15,489	54.0				
1911	60,779	16,657	37.7				
1912	91,194	30,415	50.0				
1913	119,716	28,522	31.2				
1914	123,516	3,800	3.2	----	24,709		
1915	163,795	40,279	32.6	----	26,401		
1916	235,440	71,645	43.7	----	30,999	-----	1,581
1917	310,916	75,476	32.0	----	30,417	-----	2,487
1918	370,800	59,884	19.3	674	25,973	-----	2,227
1919	493,463	112,364	30.3	1,674	28,028	-----	3,070
1920	583,623	100,459	20.8	2,300	20,564	13,000	----
1921	691,344	107,721	18.4	3,828	18,582	22,923	2,719
1922	875,970	184,626	26.7	4,861	16,301	28,780	2,731
1923	1,118,746	242,776	27.7	5,808	14,694	69,276	2,967
1924	1,338,756	220,010	19.7	19,033	12,324	48,688	2,993
1925	1,459,087	120,331	9.0	25,453	10,997	50,439	3,200
1926	1,621,855	162,768	11.2	33,085	10,872	55,180	3,299
1927	1,701,137	79,282	4.9	34,220	9,486	56,519	3,270
1928 to Sept. 30	1,775,172	74,035	4.4	38,405	9,381	51,601	3,138
Average			27.4				

DIVISION OF MOTOR VEHICLES, STATE OF CALIFORNIA



DIVISION OF MOTOR VEHICLES, STATE OF CALIFORNIA

COUNTY APPORTIONMENT OF MOTOR VEHICLE FEES FEB. 1, 1924 TO JUNE 30, 1928 INCLUSIVE

County	1924 *	1925	1926	1927	1928	TOTAL APPORTIONMENT 1924 - 1928	TOTAL APPORTIONMENT 1914 - 1928
Alameda	$ 238,561.49	$ 243,583.74	$ 265,957.70	$ 269,254.13	$ 216,957.17	$ 1,203,220.29	$ 2,659,472.63
Alpine	38.93	78.44	30.68	118.01	91.00	491.96	1,128.62
Amador	3,776.34	4,020.45	4,503.78	4,405.12	3,686.04	20,047.73	50,857.03
Butte	29,031.43	26,790.97	29,579.62	29,348.01	22,914.78	133,666.87	325,617.55
Calaveras	3,448.82	3,988.69	4,586.87	4,358.48	3,650.54	20,043.46	48,191.89
Colusa	8,296.83	9,497.28	9,906.62	9,506.56	7,332.60	45,238.88	125,045.70
Contra Costa	33,200.70	38,970.36	44,968.34	45,399.65	35,733.70	198,724.95	413,596.55
Del Norte	2,860.27	2,912.78	3,116.84	3,136.58	2,404.53	14,191.00	27,096.15
El Dorado	4,893.36	5,129.36	5,278.54	5,363.14	4,345.30	24,329.70	54,749.19
Fresno	114,254.72	120,092.14	127,182.23	122,351.35	93,769.65	577,530.09	1,574,093.99
Glenn	9,346.84	9,784.75	10,515.60	10,523.00	8,428.10	48,398.09	135,511.68
Humboldt	27,380.10	28,230.34	29,673.82	29,578.75	23,229.78	138,092.85	314,948.31
Imperial	36,300.66	41,363.02	46,230.28	42,883.68	31,825.89	193,211.53	460,815.58
Inyo	5,886.54	5,581.79	6,410.30	6,032.10	4,827.55	27,740.28	68,101.27
Kern	60,749.16	71,007.40	76,862.05	72,706.35	55,129.18	336,450.14	828,945.17
Kings	17,834.61	18,760.06	20,669.78	20,236.05	15,629.69	93,131.19	253,968.89
Lake	4,857.23	5,208.28	5,822.40	5,511.18	4,709.31	25,888.20	58,867.67
Lassen	6,445.69	8,043.88	8,468.65	8,742.99	6,513.58	38,206.79	76,957.64
Los Angeles	1,233,744.19	1,375,395.17	1,464,196.56	1,500,610.12	1,193,213.66	6,767,159.69	13,602,769.47
Madera	10,374.05	11,544.05	12,951.04	12,071.59	9,156.11	55,696.89	132,777.58
Marin	16,774.31	18,112.37	20,039.09	20,846.99	16,047.95	91,121.31	201,830.77
Mariposa	1,577.51	1,971.61	2,323.36	2,258.88	1,711.52	9,842.91	22,777.03
Mendocino	13,491.35	14,323.68	15,678.02	15,633.11	11,936.90	71,023.66	165,706.17
Merced	21,122.91	22,733.75	25,515.53	25,603.27	20,431.50	115,395.94	269,316.20
Modoc	3,357.64	3,563.73	3,715.89	3,868.42	3,277.74	17,783.47	46,224.74
Mono	560.21	625.60	805.44	758.03	628.26	3,379.54	6,620.14
Monterey	27,395.35	29,638.60	30,327.98	32,339.04	26,345.07	137,094.64	296,385.76
Napa	13,119.13	13,989.06	15,582.84	15,257.35	12,045.40	70,103.83	176,582.82
Nevada	5,611.80	5,611.80	6,536.28	6,706.73	6,853.08	31,320.16	65,394.49
Orange	81,843.67	83,495.04	90,374.03	94,907.31	72,344.89	422,689.96	1,005,394.09
Placer	16,209.63	16,950.70	18,257.13	18,269.74	14,063.17	83,450.37	186,518.61
Plumas	3,737.15	4,189.77	4,494.75	4,571.34	3,799.30	19,532.32	41,349.27
Riverside	44,887.15	48,777.43	54,147.25	60,077.49	47,763.34	257,345.63	575,801.63
Sacramento	77,474.35	87,464.13	94,736.29	94,882.78	71,794.38	427,302.93	994,347.39
San Benito	7,650.32	8,431.64	9,802.04	9,389.18	7,028.09	42,340.97	103,608.18
San Bernardino	62,001.17	74,785.56	82,941.09	88,336.03	71,003.62	365,067.46	853,538.32
San Diego	124,224.54	121,579.58	136,780.08	144,712.85	113,901.90	641,437.97	1,344,532.45
San Francisco	235,971.41	247,241.93	292,089.45	298,660.12	231,795.60	1,350,298.77	3,425,508.74
San Joaquin	66,[illegible]3.21	73,[illegible]3.46	76,931.34	77,[illegible]3.44	60,746.75	354,303.08	867,219.61
San Luis Obispo	19,289.20	19,287.69	21,377.81	21,374.37	17,559.72	97,140.41	245,341.44
San Mateo	28,132.36	34,457.04	39,201.66	41,314.31	34,316.17	177,152.33	364,783.52
Santa Barbara	37,[illegible]1.10	41,809.46	46,[illegible]8.32	48,373.31	35,399.68	204,174.10	505,215.12
Santa Clara	88,[illegible]9.41	94,995.45	135,320.84	104,676.85	83,987.03	477,898.18	1,136,330.32
Santa Cruz	23,[illegible]6.67	26,118.57	29,548.25	28,571.70	22,991.78	130,276.97	295,838.68
Shasta	10,[illegible]5.57	11,630.51	10,914.21	10,379.01	7,962.60	51,510.90	123,340.85
Sierra	1,139.9[illegible]	1,387.21	1,809.88	1,840.02	1,[illegible]35.82	7,222.59	15,096.89
Siskiyou	13,[illegible]7.75	16,256.90	18,518.50	17,829.50	12,976.41	79,311.60	168,248.72
Solano	20,[illegible]4.44	23,643.65	25,225.50	24,991.54	19,936.34	114,727.07	282,906.80
Sonoma	46,[illegible]7.94	48,497.04	52,974.48	50,993.34	40,672.25	238,210.30	568,975.99
Stanislaus	48,[illegible]1.27	47,047.54	51,738.30	51,562.12	39,665.99	234,361.40	599,832.15
Sutter	9,[illegible]1.44	10,693.10	12,[illegible]0.06	12,535.72	9,849.12	55,[illegible]8.34	126,996.81
Tehama	24,[illegible]7.11	10,507.54	11,040.32	11,137.19	8,849.94	51,[illegible]5.94	137,137.90
Trinity	1,[illegible]3.28	1,263.50	1,389.90	1,[illegible]1.20	957.36	5,[illegible]5.74	11,903.12
Tulare	53,[illegible]1.43	57,282.06	62,[illegible]6.28	60,[illegible]1....	48,866.85	283,[illegible]3.37	738,717.47
Tuolumne	6,[illegible]5.71	6,534.03	7,[illegible]5.07	6,746.79	5,[illegible]4.21	31,[illegible]5.89	70,702.51
Ventura	24,[illegible]5.[illegible]	31,[illegible]4.[illegible]	37,[illegible]7.74	38,417.48	31,143.38	164,[illegible]3.20	371,471.54
Yolo	19,[illegible]3.[illegible]	19,[illegible]1.[illegible]	21,[illegible]3.[illegible]	19,353.03	14,771.93	94,[illegible]9.27	226,695.83
Yuba	9,[illegible]1.[illegible]	9,[illegible]1.[illegible]	10,[illegible]2.[illegible]	10,[illegible]2.21	8,069.35	47,[illegible]6.97	118,827.84
Totals	$1,[illegible]9,[illegible].[illegible]	$1,[illegible]8,[illegible].[illegible]	$1,[illegible]8,[illegible].[illegible]	$1,[illegible]9,[illegible].[illegible]	$1,[illegible]9,[illegible].[illegible]	$10,[illegible]0,[illegible].[illegible]	$38,187,912.35
5 Inc[illegible] by years		11.[illegible]	4.[illegible]	1.[illegible]	Six months		*

* Fees reduced in 1924 in accordance with Vehicle Act of 1923.

STATE CONTROLLER OF CALIFORNIA

COUNTY APPORTIONMENT OF MOTOR VEHICLE FUEL TAX, OCTOBER 1, 1923 TO SEPTEMBER 30, 1928

COUNTY	OCT. 1, 1923 TO SEPT. 30, 1924	OCT. 1, 1924 TO SEPT. 30, 1925	OCT. 1, 1925 TO SEPT. 30, 1926	OCT. 1, 1926 TO SEPT. 30, 1927	OCT. 1, 1927 TO SEPT. 30, 1928	TOTAL APPORTIONMENT
Alameda	$ 411,262.04	$ 487,627.93	$ 572,634.28	$ 661,391.53	$ 711,986.06	$ 2,844,901.74
Alpine	191.81	178.87	187.75	247.88	282.13	1,088.45
Amador	7,[illegible]	8,492.57	9,054.06	10,556.62	11,686.18	47,432.42
Butte	49,[illegible]	54,706.32	61,106.35	69,720.54	75,[illegible]	310,662.28
Calaveras	6,837.07	7,704.53	9,740.57	10,435.41	11,777.53	46,495.11
Colusa	17,374.96	19,342.94	21,384.06	23,162.82	24,193.05	105,457.83
Contra Costa	[illegible]	70,[illegible]	96,411.64	110,577.07	117,[illegible]	465,351.52
Del Norte	4,469.44	5,[illegible]	6,131.30	7,266.67	7,954.06	31,586.00
El Dorado	9,521.11	10,[illegible]	11,[illegible]	12,603.36	14,146.49	58,339.00
Fresno	239,552.21	265,[illegible]	272,036.11	297,037.48	310,379.22	1,384,676.23
Glenn	18,053.95	20,131.50	21,483.00	25,453.03	27,637.91	112,759.41
Humboldt	52,779.66	59,377.[illegible]	61,[illegible]	71,084.70	76,153.43	320,935.12
Imperial	65,556.98	78,[illegible]	100,[illegible]	103,652.33	105,431.41	453,857.51
Inyo	9,851.28	11,[illegible]	12,971.53	14,473.31	14,780.47	63,163.50
Kern	117,967.83	138,791.37	1[illegible],329.17	179,106.15	183,851.95	786,039.47
Kings	36,865.71	38,628.48	43,165.99	48,518.98	51,629.33	218,827.59
Lake	8,894.66	10,541.47	12,[illegible]	13,913.21	15,328.00	60,962.09
Lassen	12,009.42	15,409.78	18,[illegible]	19,681.34	21,264.84	85,506.86
Los Angeles	2,411,806.03	2,731,960.43	3,235,[illegible]	3,582,971.21	3,918,558.79	15,880,655.02
Madera	20,711.88	22,677.52	27,231.23	29,386.78	30,483.65	130,491.06
Marin	31,723.32	37,149.80	42,[illegible]	49,853.09	54,251.22	215,142.74
Mariposa	3,194.66	3,962.38	4,711.74	5,487.58	5,680.33	23,036.69
Mendocino	26,723.42	29,745.72	32,[illegible]	37,280.24	39,285.85	165,794.71
Merced	41,678.88	45,592.84	54,[illegible]	60,714.53	66,980.16	269,096.06
Modoc	6,572.49	7,234.15	7,734.85	8,948.81	10,565.04	41,025.34
Mono	1,048.86	1,[illegible]	1,544.65	1,772.39	2,011.44	7,655.11
Monterey	41,115.64	49,600.92	63,[illegible]	74,865.52	85,182.40	314,455.31
Napa	26,655.76	29,608.96	31,[illegible]	37,195.60	39,593.33	164,881.33
Nevada	10,271.22	11,720.97	12,[illegible]	15,245.29	16,376.79	66,173.29
Orange	170,418.14	175,363.98	190,[illegible]	225,354.30	243,684.05	1,004,[illegible]
Placer	30,781.72	34,727.37	38,[illegible]	43,964.37	46,398.01	194,[illegible]
Plumas	5,991.97	7,253.27	7,[illegible]	9,913.85	10,882.35	41,[illegible]
Riverside	85,359.97	98,761.28	117,[illegible]	139,967.44	156,971.57	599,001.53
Sacramento	150,712.02	176,061.83	192,[illegible]	223,548.11	237,928.08	986,658.80
San Benito	15,194.48	16,931.96	19,[illegible]	22,618.07	23,360.20	97,189.94
San Bernardino	132,173.71	150,683.48	175,[illegible]	208,631.07	232,031.66	899,293.03
San Diego	201,142.81	238,728.07	29[illegible]	3[illegible]	374,865.16	1,453,561.67
San Francisco	474,436.54	535,473.28	[illegible]	734,[illegible]	762,844.75	3,099,523.91
San Joaquin	130,741.61	147,242.12	1[illegible]	1[illegible]	199,911.19	826,414.87
San Luis Obispo	37,299.67	39,038.72	46,[illegible]	51,344.62	57,231.99	227,865.99
San Mateo	53,823.46	68,782.01	[illegible]	98,[illegible]	111,148.61	415,780.90
Santa Barbara	70,553.80	79,720.95	121,[illegible]	106,[illegible]	115,940.37	474,771.51
Santa Clara	167,449.28	193,337.86	221,[illegible]	25[illegible]	276,280.61	1,115,[illegible]
Santa Cruz	45,881.03	53,388.42	60,[illegible]	7[illegible]	75,508.72	305,303.02
Shasta	20,530.11	23,562.62	29,[illegible]	25,415.98	26,269.83	119,734.99
Sierra	2,118.77	2,705.48	3,[illegible]	3,779.41	4,082.02	15,[illegible]
Siskiyou	25,475.61	31,048.68	3[illegible]	40,902.10	43,130.33	177,[illegible]
Solano	41,183.43	47,328.41	53,[illegible]	60,705.14	65,485.76	268,159.80
Sonoma	94,006.64	102,956.93	119,[illegible]	127,032.04	133,826.65	566,[illegible]
Stanislaus	87,277.18	97,521.47	109,[illegible]	123,022.90	131,364.40	547,433.93
Sutter	19,891.95	21,863.94	25,[illegible]	30,502.70	32,544.61	130,001.08
Tehama	19,031.25	21,231.03	24,[illegible]	26,783.68	29,069.93	119,629.77
Trinity	1,879.71	2,170.70	2,[illegible]	2,818.53	3,129.67	12,[illegible]
Tulare	111,352.11	116,246.10	135,609.[illegible]	149,755.46	160,442.36	673,505.17
Tuolumne	11,688.37	13,105.36	14,970.61	16,124.35	16,782.51	72,671.20
Ventura	51,558.48	58,283.79	79,011.[illegible]	90,967.58	101,871.68	382,652.92
Yolo	32,317.87	36,410.31	41,381.[illegible]	46,311.60	48,915.85	205,337.40
Yuba	18,012.70	19,[illegible]53.33	21,559.57	24,557.61	26,806.09	11[illegible]
Totals	$6,063,072.76	$6,[illegible]	$8,027,579.99	$9,041,025.12	$ 9,798,907.38	$39,799,531.20

REGISTRATION		TOTAL 2¢ FUEL TAX APPORTIONED		AVERAGE PER VEHICLE
July 31, 1924	1,220,057	Oct. 1, 1923-Sept. 30, 1924	$12,126,145.51	$ 9.9360
July 31, 1925	1,327,612	Oct. 1, 1924-Sept. 30, 1925	13,737,891.89	10.3478
June 30, 1926	1,467,635	Oct. 1, 1925-Sept. 30, 1926	16,055,159.98	10.9395
June 30, 1927	1,592,845	Oct. 1, 1926-Sept. 30, 1927	18,082,050.26	11.3520
June 30, 1928	1,671,607	Oct. 1, 1927-Sept. 30, 1928	19,597,[illegible]04.77	11.7239
			$79,599,062.41	

STATE HIGHWAY CONSTRUCTION FUND 1¢ GAS TAX

July 29, 1927 to September 30, 1927	$ 1,[illegible]
October 1, 1927 to September 30, 1928	[illegible]
	$11,099,31[illegible]

DIVISION OF MOTOR VEHICLES, STATE OF CALIFORNIA

APPORTIONMENT OF MOTOR VEHICLE FEES FOR THE PERIOD JULY 1, 1926 TO DEC. 31, 1926

COUNTY	REGISTRATION						APPORTIONED TO COUNTIES
	AUTOS	TRUCKS SOLID TIRES	TRUCKS PNEU. TIRES	MOTOR-CYCLES	TRAIL-ERS	TOTAL	$ 6.682288105
Alameda	7,583	144	1,066	113	179	9,085	$51,623.56
Alpine	2					2	11.35
Amador	113	5	23	1	2	144	816.46
Butte	988	13	147	8	72	1,228	6,977.85
Calaveras	153	5	26		4	189	1,073.95
Colusa	298	4	44	1	17	364	2,068.35
Contra Costa	1,533	30	177	24	39	1,803	10,245.15
Del Norte	103	3	23	2	5	136	772.52
El Dorado	145	7	35	1	7	196	1,113.73
Fresno	4,204	130	578	55	358	5,325	30,253.87
Glenn	300	8	36	1	54	399	2,267.23
Humboldt	880	28	152	4	15	1,085	6,166.01
Imperial	1,563	15	251	9	41	1,890	10,736.52
Inyo	274	2	43	1	3	323	1,835.40
Kern	2,557	33	333	39	174	3,136	17,819.65
Kings	682	11	85	3	105	886	5,034.51
Lake	153	9	38		5	215	1,221.69
Lassen	272	4	44	4	7	331	1,881.06
Los Angeles	42,540	719	6,063	437	1,098	57,013	323,964.30
Madera	389	11	71	7	29	507	2,880.52
Marin	574	11	85	6	8	684	3,886.68
Mariposa	75	4	14		2	95	539.82
Mendocino	457	28	115	5	13	628	3,568.48
Merced	864	10	142	6	77	1,099	6,244.83
Modoc	116	5	19		5	145	823.95
Mono	36		6			42	238.66
Monterey	1,080	23	172	20	53	1,348	7,659.72
Napa	455	24	85	9	22	595	3,381.64
Nevada	212	3	37	1	10	253	1,464.44
Orange	2,999	22	378	28	147	3,574	20,308.50
Placer	589	10	82	4	18	703	3,994.65
Plumas	188	3	26	3	3	223	1,267.15
Riverside	1,845	26	252	17	140	2,281	12,961.30
Sacramento	3,115	83	485	32	155	3,870	21,990.45
San Benito	383	8	51	7	28	477	2,710.45
San Bernardino	2,577	27	485	31	87	3,207	18,223.10
San Diego	4,510	65	652	64	151	5,572	31,661.71
San Francisco	9,692	292	1,587	104	113	11,788	66,982.81
San Joaquin	2,350	70	406	22	163	3,011	17,109.37
San Luis Obispo	728	15	115	2	26	886	5,034.51
San Mateo	1,204	37	161	19	29	1,450	8,239.32
Santa Barbara	1,648	13	236	15	51	1,883	10,699.75
Santa Clara	3,142	133	531	65	203	4,074	23,146.64
Santa Cruz	922	23	153	18	38	1,154	6,557.36
Shasta	289	8	70	4	11	382	2,170.63
Sierra	81	3	13		5	102	579.69
Siskiyou	750	18	108	5	12	893	5,074.28
Solano	838	8	95	13	26	970	5,511.82
Sonoma	1,428	55	274	15	36	1,808	10,273.38
Stanislaus	1,524	31	302	29	178	2,064	11,728.24
Sutter	424	19	96	2	51	592	3,363.91
Tehama	340	8	50	3	26	427	2,426.34
Trinity	24	3	7			34	193.20
Tulare	1,865	42	277	13	203	2,430	13,807.99
Tuolumne	267	4	37		5	313	1,778.55
Ventura	1,468	18	182	12	57	1,737	9,870.14
Yolo	632	6	87	9	33	767	4,358.32
Yuba	385	8	78	1	19	491	2,790.00
Totals	121,019	2,349	17,207	1,325	4,422	146,322	$831,443.76

Total Income Motor Vehicle Fees	$ 916,884.81	One-half to Counties	$831,443.76
Balance Unapportioned 6-30-26	937,928.84	One-half to State	$831,443.75
Total	1,854,813.65		
Expenditures	191,326.14		
Balance Apportioned	1,663,487.51		

DIVISION OF MOTOR VEHICLES, STATE OF CALIFORNIA

APPORTIONMENT OF MOTOR VEHICLE FEES FOR THE PERIOD JAN. 1, 1927 TO JUNE 30, 1927

COUNTY	REGISTRATION						APPORTIONED TO COUNTIES 1.887217562
	AUTOS	TRUCKS SOLID TIRES	TRUCKS PNEU. TIRES	MOTOR-CYCLES	TRAIL-ERS	TOTAL	
Alameda	103,854	2,686	10,515	804	1,058	118,917	[illegible]
Alpine	42		3		1	46	86.81
Amador	1,599	53	232	4	13	1,901	3,587.60
Butte	10,499	191	1,318	54	374	12,436	23,469.44
Calaveras	1,483	67	246	2	32	1,830	3,453.61
Colusa	3,391	94	471	13	132	4,101	7,739.48
Contra Costa	17,311	430	1,807	178	232	19,958	37,665.09
Del Norte	1,013	30	230	3	21	1,297	2,447.72
El Dorado	1,793	62	357	10	18	2,240	4,227.37
Fresno	43,642	1,333	5,072	267	2,401	52,715	99,494.67
Glenn	3,679	77	429	16	373	4,574	8,632.13
Humboldt	10,879	296	1,366	43	90	12,674	23,918.60
Imperial	15,144	266	2,425	49	352	18,236	34,415.30
Inyo	2,265	37	272	9	28	2,611	4,927.53
Kern	26,827	664	3,220	177	1,011	31,899	60,200.35
Kings	6,953	161	832	25	642	8,613	16,254.60
Lake	2,064	98	300	6	29	2,497	4,712.38
Lassen	3,048	38	333	12	51	3,482	6,571.29
Los Angeles	562,768	13,753	57,769	2,435	7,553	644,278	1,215,892.76
Madera	4,341	94	553	20	208	5,216	9,843.73
Marin	7,518	213	1,162	43	30	8,966	16,920.79
Mariposa	760	36	169	5	12	982	1,853.25
Mendocino	5,486	182	928	27	47	6,670	12,587.74
Merced	8,795	210	1,321	48	501	10,875	20,523.49
Modoc	1,423	18	157	1	11	1,610	3,038.42
Mono	275	2	41	1		319	602.02
Monterey	11,224	304	1,631	100	324	13,583	25,634.08
Napa	5,527	236	715	55	90	6,623	12,499.04
Nevada	2,286	51	378	7	16	2,738	5,167.20
Orange	35,088	530	3,518	173	1,477	40,786	76,972.06
Placer	6,492	152	1,078	37	113	7,872	14,856.18
Plumas	1,461	35	236	10	9	1,751	3,304.52
Riverside	21,190	319	2,733	129	1,028	25,399	47,933.10
Sacramento	33,025	1,001	4,701	260	751	39,738	74,994.25
San Benito	3,406	97	413	23	95	4,034	7,613.04
San Bernardino	32,158	499	4,134	205	890	37,886	71,499.12
San Diego	53,669	980	5,997	525	702	61,873	116,767.81
San Francisco	105,857	4,749	14,034	798	5[illegible]	126,[illegible]	237,721.47
San Joaquin	27,015	726	3,758	190	1,268	32,957	62,197.03
San Luis Obispo	7,833	151	1,095	31	159	9,269	17,492.62
San Mateo	15,023	572	1,940	113	186	17,834	33,656.64
Santa Barbara	16,035	300	2,875	109	245	19,564	36,921.64
Santa Clara	38,184	1,277	4,813	344	1,368	45,986	86,785.59
Santa Cruz	10,660	308	1,465	124	159	12,716	23,997.86
Shasta	3,666	140	603	14	78	4,501	8,494.37
Sierra	556	9	91	2	6	664	1,253.11
Siskiyou	6,313	103	765	18	43	7,[illegible]	13,667.23
Solano	9,221	256	1,134	64	170	10,[illegible]	20,466.87
Sonoma	18,115	616	3,588	137	249	22,[illegible]	42,849.27
Stanislaus	17,872	305	2,191	129	1,352	21,849	41,233.82
Sutter	4,316	184	818	17	160	5,[illegible]	10,370.26
Tehama	3,982	73	511	21	243	4,[illegible]	9,115.26
Trinity	[illegible]	10	60		4	[illegible]	572.47
Tulare	21,610	556	2,792	121	1,677	26,[illegible]	50,494.39
Tuolumne	2,479	52	308	5	20	2,864	5,404.99
Ventura	13,946	255	1,730	74	582	16,587	31,303.28
Yolo	6,741	205	[illegible]	33	[illegible]	[illegible]	15,552.56
Yuba	3,647	83	579	6	90	4,405	8,313.19
Totals	1,385,894	36,225	162,604	8,122	29,570	1,622,415	3,061,850.08

Total Income Motor Vehicle Fees	$7,654,625.20	One-half to Counties	$3,061,850.08
Expenditures (estimated at 20%)	1,530,925.04	One-half to State	3,061,850.08
Balance apportioned	$6,123,700.16		

DIVISION OF MOTOR VEHICLES, STATE OF CALIFORNIA

APPORTIONMENT OF MOTOR VEHICLE FEES FOR THE PERIOD JULY 1, 1927 TO DEC 31, 1927

COUNTY	REGISTRATION						APPORTIONED TO COUNTIES 6.240517272
	AUTOS	TRUCKS SOLID TIRES	TRUCKS PNEU. TIRES	MOTOR-CYCLES	TRAIL-ERS	TOTAL	
Alameda	6,091	115	694	102	182	7,184	44,831.88
Alpine	3	1	1			5	31.20
Amador	104	7	17	1	2	131	817.52
Butte	701	15	130	8	88	942	5,878.57
Calaveras	108	1	33	1	2	145	904.87
Colusa	220	8	23	1	31	283	1,766.07
Contra Costa	1,045	16	104	25	43	1,233	7,694.56
Del Norte	76	6	32		6	120	748.86
El Dorado	135	7	34	1	5	182	1,135.77
Fresno	2,695	128	421	37	364	3,645	22,746.68
Glenn	214	8	36	4	41	303	1,890.87
Humboldt	747	32	107	4	17	907	5,660.15
Imperial	1,114	7	169	16	51	1,357	8,468.38
Inyo	131	1	39	1	5	177	1,104.57
Kern	1,568	22	195	29	190	2,004	12,506.00
Kings	456	12	72	7	91	638	3,981.45
Lake	83	11	27	3	4	128	798.80
Lassen	290	10	32	1	15	348	2,171.70
Los Angeles	38,869	426	4,877	434	1,018	45,624	284,717.36
Madera	250	11	49	12	35	357	2,227.86
Marin	434	10	80	5	4	533	3,326.20
Mariposa	45	2	15	2	1	65	405.63
Mendocino	371	29	67	6	15	488	3,045.37
Merced	570	12	121	14	97	814	5,079.78
Modoc	115	4	12		2	133	830.00
Mono	21		4			25	156.01
Monterey	912	19	129	16	78	1,154	7,201.56
Napa	314	23	77	9	19	442	2,758.31
Nevada	139	2	33		7	181	1,129.53
Orange	2,350	22	313	48	141	2,874	17,935.25
Placer	426	21	70	9	21	547	3,413.56
Plumas	154	8	37		4	203	1,266.82
Riverside	1,529	20	226	28	143	1,946	12,144.05
Sacramento	2,488	84	421	28	166	3,187	19,888.53
San Benito	193	8	44	5	25	275	1,716.14
San Bernardino	2,223	21	316	31	107	2,698	16,836.91
San Diego	3,752	24	497	95	110	4,478	27,945.04
San Francisco	8,265	210	1,073	114	103	9,765	60,938.65
San Joaquin	1,751	63	361	26	208	2,409	15,033.41
San Luis Obispo	480	11	75	5	35	606	3,781.75
San Mateo	976	27	144	9	23	1,179	7,357.57
Santa Barbara	1,280	13	190	19	35	1,537	9,591.67
Santa Clara	2,204	129	319	44	203	2,899	18,091.26
Santa Cruz	600	22	108	8	43	781	4,873.84
Shasta	212	17	47	5	21	302	1,884.64
Sierra	51	2	8		1	62	386.91
Siskiyou	541	19	100	3	20	683	4,262.27
Solano	593	15	55	20	42	725	4,524.37
Sonoma	963	60	214	16	53	1,306	8,150.12
Stanislaus	1,171	25	235	22	203	1,656	10,334.30
Sutter	227	25	51	2	42	347	2,165.46
Tehama	242	9	34	2	37	324	2,021.93
Trinity	25	2			1	28	174.73
Tulare	1,174	28	220	15	238	1,675	10,452.86
Tuolumne	188	4	21	1	1	215	1,341.71
Ventura	925	19	129	17	50	1,140	7,114.20
Yolo	456	21	84	8	40	609	3,800.47
Yuba	257	15	44	3	27	346	2,159.22
Totals	93,517	1,889	13,066	1,322	4,556	114,350	713,603.15

Total Income Motor Vehicle Fees	$ 851,399.13	One-half to Counties	$713,603.15
Balance Unapportioned 6-30-27	946,848.31	One-half to State	$713,603.15
Total	1,798,247.44		
Expenditures	371,041.14		
Balance Apportioned	$1,427,206.30		

DIVISION OF MOTOR VEHICLES, STATE OF CALIFORNIA

APPORTIONMENT OF MOTOR VEHICLE FEES FOR THE PERIOD JAN. 1, 1928 TO JUNE 30, 1928

COUNTY	REGISTRATION						APPORTIONED TO COUNTIES 1,750021505
	AUTOS	TRUCKS SOLID	TRUCKS PNEU.	MOTOR-CYCLES	TRAIL-ERS	TOTAL	
Alameda	109,291	2,912	9,927	783	1,061	123,974	216,957.17
Alpine	44	2	4	1	1	52	91.00
Amador	1,759	48	251	3	11	2,072	3,626.04
Butte	10,985	168	1,411	54	476	13,094	22,914.78
Calaveras	1,735	57	252	7	45	2,086	3,650 54
Colusa	3,446	75	499	6	164	4,190	7,332.60
Contra Costa	17,821	444	1,739	171	244	20,419	35,733.70
Del Norte	1,076	29	242	4	23	1,374	2,404.53
El Dorado	2,012	62	376	10	23	2,483	4,345.30
Fresno	44,122	1,232	5,201	245	2,782	53,582	93,769.65
Glenn	3,839	71	448	17	441	4,816	8,428.10
Humboldt	11,498	244	1,390	44	98	13,274	23,229.79
Imperial	15,177	215	2,358	49	387	18,186	31,825.89
Inyo	2,198	23	279	2	28	2,530	4,427.55
Kern	26,455	586	3,143	163	1,155	31,502	55,129.18
Kings	7,208	136	875	29	678	8,926	15,620 69
Lake	2,262	79	312	12	26	2,691	4,709.31
Lassen	3,268	25	336	24	69	3,722	6,513.58
Los Angeles	599,589	13,044	58,933	2,462	7,743	681,828	1,193,213.66
Madera	4,332	81	542	32	245	5,232	9,156.11
Marin	8,017	232	1,163	58	43	9,513	16,647.95
Mariposa	917	17	125	5	14	978	1,711.52
Mendocino	5,632	145	962	26	56	6,821	11,936.90
Merced	9,505	157	1,362	64	587	11,675	20,431.50
Modoc	1,651	19	187	1	15	1,873	3,277.79
Mono	307	2	46		4	359	628.26
Monterey	12,462	270	1,750	103	412	14,997	26,245.07
Napa	5,777	202	768	49	87	6,883	12,045.40
Nevada	3,362	70	418	12	54	3,916	6,853.08
Orange	35,423	420	3,662	204	1,459	41,168	72,044.89
Placer	6,658	133	1,100	28	117	8,036	14,063 17
Plumas	1,851	33	260	12	15	2,171	3,799.30
Riverside	22,800	292	2,951	155	1,075	27,293	47,763.34
Sacramento	34,322	836	4,792	206	796	41,002	71,754.38
San Benito	3,386	83	420	34	93	4,016	7,028.09
San Bernardino	34,742	429	4,298	188	916	40,573	71,003.62
San Diego	57,073	831	6,032	517	633	65,086	113,901.90
San Francisco	112,415	5,057	13,653	774	554	132,453	231,795.60
San Joaquin	28,515	711	3,889	199	1,398	34,712	60,746 75
San Luis Obispo	8,566	121	1,114	47	186	10,034	17,559.72
San Mateo	16,814	575	1,993	116	201	19,609	34,316.17
Santa Barbara	17,139	355	2,354	100	273	20,171	35,299.68
Santa Clara	40,293	1,128	4,975	316	1,330	47,992	83,987.03
Santa Cruz	11,271	361	1,493	107	196	13,138	22,991.78
Shasta	3,709	139	594	14	104	4,550	7,962.60
Sierra	606	4	92	2	2	706	1,235.52
Siskiyou	6,443	92	758	22	80	7,415	12,976.41
Solano	9,735	238	1,141	76	202	11,392	19,936.24
Sonoma	18,533	576	3,736	128	268	23,241	40,672.25
Stanislaus	18,558	240	2,294	120	1,454	22,666	39,665.99
Sutter	4,466	155	828	15	164	5,628	9,849.12
Tehama	4,160	65	582	19	291	5,057	8,849
Trinity	480	10	94	1	2	547	957.26
Tulare	22,444	442	2,942	132	1,943	27,923	48,865 85
Tuolumne	2,900	42	324	11	20	2,937	5,069 91
Ventura	14,313	264	1,940	60	619	17,796	31,143.38
Yolo	6,741	173	1,042	30	305	8,441	14,771.93
Yuba	3,937	70	587	10	107	4,611	8,069.35
Totals	1,494,060	34,359	165,109	8,079	31,765	1,703,372	2,980,937.63

Total Income Motor Vehicle Fees $7,948,167.00 One-half to Counties $2,980,937.63
Expenditures (estimated at 25%) 1,[illegible] One-half to State 2,980,937.62
Balance Apportioned [illegible]

STATE CONTROLLER OF CALIFORNIA

MOTOR VEHICLE FUEL TAX APPORTIONMENT, OCTOBER 1, 1926 TO SEPTEMBER 30, 1927

COUNTY	REGISTRATION 1926-JAN 1.-DEC 31.INCL.	APPORTIONED DEC.31, 1926	REGISTRATION 1927- JAN.1- MAR.31.INCL.	APPORTIONED MAR.31 1927	REGISTRATION 1927- JAN 1- SEPT 30.INCL.	APPORTIONED SEPT.30,1927	TOTAL APPORTIONMENT
Alameda	119,575	$ 150,651.38	111,979	$ 151,060.67	123,401	$ 359,679.48	$ 661,391.53
Alpine	43	54.18	42	56.72	47	136.99	247.89
Amador	1,920	2,418.99	1,778	2,398.54	1,969	5,738.39	10,556.62
Butte	12,912	16,267.70	11,529	15,552.72	13,003	37,900.12	69,720.54
Calaveras	2,005	2,526.08	1,706	2,301.41	1,924	5,607.92	10,435.41
Colusa	4,416	5,563.68	3,779	5,097.90	4,289	12,501.24	23,162.82
Contra Costa	19,748	24,880.31	18,619	25,117.30	20,784	60,579.56	110,577.07
Del Norte	1,340	1,688.35	1,160	1,564.85	1,377	4,013.57	7,266.67
El Dorado	2,349	2,959.48	2,080	2,805.94	2,346	6,837.34	12,603.36
Fresno	55,428	69,833.30	49,938	67,366.81	54,838	159,837.47	297,037.48
Glenn	4,663	5,874.87	4,237	5,715.75	4,756	13,862.41	25,453.03
Humboldt	13,230	16,668.35	11,608	15,659.30	13,257	38,657.05	71,084.70
Imperial	20,238	25,497.66	16,671	22,489.33	19,098	55,665.34	103,652.33
Inyo	2,688	3,386.58	2,335	3,149.94	2,723	7,936.79	14,473.31
Kern	33,658	42,405.39	29,964	40,421.70	33,032	96,279.06	179,106.15
Kings	8,979	11,312.55	8,070	10,886.50	9,030	26,319.93	48,518.98
Lake	2,583	3,254.30	2,329	3,141.84	2,579	7,517.12	13,913.21
Lassen	3,746	4,719.55	3,008	4,057.82	3,741	10,904.24	19,681.34
Los Angeles	646,405	814,399.38	605,014	816,169.29	669,842	1,952,402.54	3,582,971.21
Madera	3,506	4,416.96	4,890	6,596.65	5,439	15,853.17	29,386.78
Marin	9,034	11,381.85	8,381	11,306.04	9,320	27,165.20	49,853.09
Mariposa	1,017	1,281.31	925	1,247.83	1,015	2,958.44	5,487.58
Mendocino	6,887	8,676.86	6,122	8,258.63	6,980	20,344.75	37,280.34
Merced	11,061	13,935.65	10,056	13,565.63	11,395	33,213.25	60,714.53
Modoc	1,640	2,066.22	1,444	1,947.97	1,693	4,934.62	8,948.81
Mono	335	422.06	275	370.98	336	979.35	1,772.39
Monterey	13,055	16,447.87	12,474	16,827.54	14,269	41,590.15	74,865.56
Napa	6,906	8,700.80	6,223	8,394.88	6,896	20,099.92	37,195.60
Nevada	2,812	3,542.81	2,481	3,346.89	2,866	8,353.59	15,243.29
Orange	39,797	50,139.85	38,303	51,671.09	42,386	123,543.36	225,354.30
Placer	8,076	10,174.87	7,298	9,845.07	8,215	23,944.43	43,964.37
Plumas	1,876	2,363.55	1,509	2,035.65	1,892	5,514.65	9,913.85
Riverside	24,606	31,000.86	23,527	31,738.13	26,496	77,228.45	139,967.44
Sacramento	41,476	52,255.21	36,835	49,690.74	41,730	121,602.16	223,548.11
San Benito	4,143	5,219.73	3,803	5,130.28	4,209	12,268.06	22,618.07
San Bernardino	36,663	46,191.36	35,084	47,328.63	39,493	115,111.08	208,631.07
San Diego	59,913	75,483.81	58,438	78,833.38	64,509	188,025.74	342,342.93
San Francisco	128,157	161,463.76	117,143	158,026.95	132,078	384,970.52	704,461.23
San Joaquin	33,936	42,755.64	30,783	41,526.54	34,414	100,307.21	184,589.39
San Luis Obispo	9,314	11,734.62	8,560	11,547.52	9,645	28,112.48	51,394.62
San Mateo	17,456	21,992.64	16,769	22,621.53	18,584	54,167.17	98,781.34
Santa Barbara	19,971	25,161.27	17,595	23,735.81	19,850	57,857.21	106,754.29
Santa Clara	46,594	58,692.93	43,331	58,463.91	47,871	139,530.81	256,637.45
Santa Cruz	12,882	16,229.91	11,837	15,968.22	13,239	38,587.99	70,786.12
Shasta	4,902	6,175.98	4,103	5,534.98	4,702	13,705.02	25,415.98
Sierra	738	929.80	574	774.33	712	2,075.28	3,779.41
Siskiyou	7,843	9,881.32	6,354	8,571.60	7,702	22,449.18	40,902.10
Solano	11,161	14,061.64	10,068	13,581.82	11,343	33,061.62	60,705.14
Sonoma	23,417	29,502.85	21,429	28,907.91	23,543	68,621.28	127,032.04
Stanislaus	22,742	28,652.42	20,520	27,681.66	22,880	66,688.82	123,022.90
Sutter	5,454	6,871.44	5,150	6,947.40	5,724	16,683.86	30,502.70
Tehama	4,880	6,148.26	4,446	5,997.69	5,022	14,637.75	26,783.68
Trinity	496	624.91	468	631.33	536	1,562.39	2,818.53
Tulare	27,677	34,869.98	25,241	34,054.38	27,732	80,831.04	149,755.40
Tuolumne	2,989	3,765.81	2,662	3,591.06	3,008	8,767.48	16,124.35
Ventura	15,833	19,947.84	15,498	20,906.94	17,193	50,112.80	90,967.58
Yolo	8,631	10,874.11	7,610	10,265.96	8,636	25,171.53	46,311.60
Yuba	4,532	5,709.83	4,024	5,428.41	4,604	13,419.37	24,557.61
Totals	1,640,294	$2,066,590.47	1,518,982	$2,047,906.19	1,690,223	$4,926,528.46	$9,041,025.12

Collections 2¢ tax to Sept. 30, 1927	$19,724,633.83	State Highway Construction Fund	
Less refunds and expended	1,642,583.57		
Balance apportioned	$18,082,050.26	Collections 1¢ tax July 29, 1927 to September 30, 1927	$1,770,315.70
1/2 to Counties	$ 9,041,025.12	Less refunds	211,417.14
1/2 to State Highway Maintenance Fund	$ 9,041,025.14	Balance to State Highway Construction Fund	$1,558,898.56

STATE CONTROLLER OF CALIFORNIA

VEHICLE FUEL TAX APPORTIONMENT, OCTOBER 1, 1927 TO SEPTEMBER 30, 1928

COUNTY	REGISTRATION [illegible]-JAN. [illegible] DEC 31, INCL.	APPORTIONED DEC 31, 1927	REGISTRATION 1928-JAN 1,- MAR 31, INCL	APPORTIONED MAR 31, 1928	REGISTRATION 1928-JAN 1,- SEPT. 30, INCL	APPORTIONED [illegible] 30, 1928	TOTAL APPORTIONMENT
[illegible]	126,101	$ [illegible]	117,135	$ 167,942.91	[illegible]	$ 371,991.64	$ 711,985.06
[illegible]	51	69.74	[illegible]	70.25	[illegible]	[illegible]	392.13
[illegible]	[illegible]	2,778.64	1,[illegible]	2,761.41	[illegible]	6,145.93	11,686.18
[illegible]	13,378	12,[illegible]	12,[illegible]	17,[illegible]	14,[illegible]	49,247.64	79,193.91
[illegible]	1,975	2,700.90	1,[illegible]	2,[illegible]	[illegible]	6,843.53	11,777.53
Colusa	4,384	5,995.91	[illegible]	5,[illegible]	4,[illegible]	12,534.37	24,193.05
Contra Costa	21,191	28,973.60	13,[illegible]	27,452.11	21,[illegible]	61,292.78	117,724.49
Del Norte	1,417	1,937.91	1,[illegible]	1,802.23	1,[illegible]	4,214.02	7,954.06
El Dorado	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7,475.01	14,146.49
Fresno	[illegible]	77,074.70	[illegible]	75,[illegible]	[illegible]	180,113.75	310,379.22
Glenn	4,877	6,669.51	4,[illegible]	[illegible]	[illegible]	14,459.15	27,637.91
Humboldt	13,581	18,577.60	1[illegible]	17,[illegible]	[illegible]	39,977.00	76,153.43
Imperial	19,593	26,794.34	18,[illegible]	25,[illegible]	[illegible]	54,822.48	107,411.43
Inyo	[illegible]	3,812.71	[illegible]	3,572.19	[illegible]	7,595.57	[illegible]
Kern	[illegible]	[illegible]	[illegible]	42,[illegible]	[illegible]	94,626.04	[illegible]
Kings	[illegible]	12,641.14	[illegible]	12,120.97	[illegible]	26,857.22	[illegible]
Lake	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8,069.22	[illegible]
[illegible]	[illegible]	5,217.69	[illegible]	4,731.39	[illegible]	11,395.76	[illegible]
Los Angeles	[illegible]	943,470.93	[illegible]	923,[illegible]	[illegible]	2,048,339.14	[illegible]
[illegible]	[illegible]	7,671.12	[illegible]	7,117.16	[illegible]	15,745.17	[illegible]
Marin	9,489	12,[illegible]	[illegible]	12,[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1,047	1,[illegible]	[illegible]	1,[illegible]	[illegible]	2,[illegible]	[illegible]
[illegible]	7,159	9,[illegible]	[illegible]	9,[illegible]	[illegible]	20,372.56	[illegible]
Merced	11,683	15,[illegible]	10,[illegible]	15,[illegible]	[illegible]	35,316.94	[illegible]
Modoc	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5,729.69	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,076.47	[illegible]
Monterey	14,717	20,153.48	13,[illegible]	19,[illegible]	[illegible]	45,033.77	[illegible]
[illegible]	[illegible]	9,661.69	[illegible]	9,338.05	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	49,708.91	[illegible]	46,[illegible]	43,975	127,687.91	[illegible]
Placer	[illegible]	11,513.94	[illegible]	10,837.76	[illegible]	31,046.91	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Riverside	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sacramento	[illegible]	58,701.77	[illegible]	54,[illegible]	[illegible]	[illegible]	[illegible]
San Benito	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
San Bernardino	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
San Diego	66,351	90,737.82	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
San Francisco	135,739	185,615.19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
San Joaquin	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
San Luis Obispo	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
San Mateo	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Santa Barbara	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Santa Clara	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Santa Cruz	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Shasta	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sierra	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Siskiyou	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solano	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sonoma	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stanislaus	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sutter	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tehama	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Trinity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tulare	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tuolumne	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ventura	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yolo	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yuba	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals	1,736,765	$2,375,100.16	1,608,993	$2,306,902.19	1,782,589	$5,116,905.12	[illegible]

Collections of tax to Sept. 30, 1928 [illegible]
Less refunds and expended [illegible]
Balance apportioned [illegible]

1/2 to Counties $ [illegible]
1/2 to State Highway Maintenance Fund $ 9,798,907.39

STATE HIGHWAY CONSTRUCTION FUND 1¢ GAS TAX OCTOBER 1, 1927 TO SEPTEMBER 30, 1928

	Oct. 1, 1927- [illegible] 31, 1927	Jan. 1, 1928- Mar 31, 1928	Apr. 1, 1928- Sept. 30, 1928	Totals
Collections	[illegible]	[illegible]	$5,660,208.00	[illegible]
Retained previous quarter	[illegible]	[illegible]	50,000.00	[illegible]
Sub-total	$9,522,594.30	[illegible]	$5,719,208.00	$10,722,595.61
Less refunds and retained	793,158.76	[illegible]	713,379.52	1,182,177.75
Balance to State Highway Construction Fund	$8,729,435.54	$8,305,153.91	[illegible]	$ 9,540,417.86

STATE CONTROLLER OF CALIFORNIA

State Line Franchise Tax Apportionment to June 30, 19[illegible]

	Registration January 1, 1926 to December 31, 1926	Apportioned to December 31, 1927	Registration January 1, 1927 to December 31, 1927	Apportioned to June 30, 1928	Total Apportionment
Alameda	119,575	$ 17,0[illegible].35	128,101	$ 10,157.99	$ 27,224.34
Alpine	43	[illegible].14	51	4.12	10.36
Amador	1,920	274.03	2,032	163.69	437.72
Butte	12,912	1,8[illegible].37	13,378	1,077.66	2,920.53
Calaveras	2,005	28[illegible].10	1,975	159.09	445.25
Colusa	4,416	630.27	4,344	353.15	983.42
Contra Costa	19,[illegible]	2,[illegible].53	21,191	1,707.03	4,509.56
Del Norte	1,340	191.25	1,417	114.15	305.40
El Dorado	2,319	330.[illegible]	[illegible]	195.10	530.36
Fresno	55,[illegible]	7,910.37	56,360	4,540.04	12,451.01
Glenn	4,663	[illegible].53	4,877	392.[illegible]	1,058.39
Humboldt	13,230	1,[illegible].25	13,581	1,094.00	2,982.25
Imperial	20,[illegible]	2,[illegible].47	19,593	1,577.[illegible]	4,4[illegible].77
Inyo	2,[illegible]	[illegible].24	2,7[illegible]	[illegible].59	60[illegible].23
Kern	33,658	4,803.24	33,903	2,731.03	7,534.87
Kings	8,979	1,[illegible].53	9,351	745.21	2,026.74
Lake	[illegible],[illegible]47	[illegible].[illegible]	2,635	211.[illegible]	5[illegible].12
Lassen	3,746	[illegible].[illegible]	3,[illegible]30	3[illegible].[illegible]	843.17
Los Angeles	646,405	92,[illegible].70	699,902	55,574.[illegible]	147,[illegible]32.82
Madera	5,[illegible]6	7[illegible].24	5,573	44[illegible].93	1,234.77
Marin	9,034	1,[illegible].37	9,499	765.19	2,054.57
Mariposa	1,017	14[illegible].15	1,047	[illegible].34	229.49
Mendocino	6,887	[illegible].[illegible]	7,158	57[illegible].61	1,559.56
Merced	11,061	1,57[illegible].[illegible]	11,679	941.60	2,520.28
Modoc	1,840	25[illegible].07	1,743	140.41	374.48
Mono	335	[illegible]7.[illegible]	344	27.71	75.52
Monterey	13,055	1,[illegible].[illegible]	14,737	1,187.13	3,050.41
Napa	6,906	[illegible].[illegible]	7,065	569.12	1,554.78
Nevada	2,512	401.[illegible]	2,919	227.08	608.42
Orange	39,797	5,[illegible].03	43,660	3,516.00	9,197.03
Placer	8,076	1,[illegible].[illegible]	8,419	678.19	1,830.24
Plumas	1,[illegible]	[illegible].75	1,954	157.40	425.15
Riverside	24,606	3,511.[illegible]	27,345	2,202.76	5,714.65
Sacramento	41,476	5,[illegible].67	42,925	3,457.[illegible]	9,377.47
San Benito	4,143	[illegible].31	4,309	347.11	938.42
San Bernardino	36,663	5,[illegible].73	40,564	3,269.22	8,501.95
San Diego	59,913	8,[illegible].29	66,351	5,344.66	13,895.95
San Francisco	128,157	18,[illegible].[illegible]	135,779	10,933.56	29,224.78
San Joaquin	33,936	4,[illegible].52	35,368	2,[illegible].[illegible]	7,692.41
San Luis Obispo	9,314	1,[illegible].34	9,875	795.47	2,124.81
San Mateo	17,456	2,[illegible].41	19,013	1,531.58	4,022.99
Santa Barbara	19,971	2,[illegible].37	20,497	1,651.12	4,501.49
Santa Clara	46,594	6,[illegible].42	48,[illegible]	3,937.90	10,582.32
Santa Cruz	12,882	1,[illegible].[illegible]	13,497	1,087.24	2,925.82
Shasta	4,902	69[illegible].64	4,803	386.90	1,086.54
Sierra	738	105.33	726	58.48	163.81
Siskiyou	7,843	1,119.39	7,925	638.39	1,757.78
Solano	11,161	1,59[illegible].[illegible]	11,570	932.01	2,524.96
Sonoma	23,417	3,342.30	24,011	1,934.19	5,276.39
Stanislaus	22,742	3,[illegible].[illegible]	23,505	1,893.43	5,139.28
Sutter	5,454	77[illegible].42	5,842	470.60	1,249.02
Tehama	4,[illegible]	6[illegible].50	5,154	415.1[illegible]	1,111.68
Trinity	496	70.79	547	[illegible].06	114.[illegible]
Tulare	27,677	3,[illegible].70	28,431	2,290.24	6,240.14
Tuolumne	2,989	[illegible].60	3,079	248.03	674.63
Ventura	15,[illegible]33	2,[illegible].77	17,727	1,427.99	3,[illegible]7.76
Yolo	8,631	1,231.87	8,850	712.91	1,[illegible]4.78
Yuba	4,532	64[illegible].83	4,751	390.77	1,037.60
Totals	1,640,294	$ 234,111.08	1,736,765	$ 139,904.01	$ 374,015.09

Total apportioned to counties	$ 374,015.09
Total to State Highway Maintenance Fund	374,015.09
Total Net Tax Levy	$ 748,030.18

CONTRACT STATISTICS

(a) Completed Contracts—June 30, 1928.

(b) Incomplete Contracts—June 30, 1928.

COMPLETED CONTRACTS—JUNE 30, 1928

CONTRACT NUMBER	DIV	COUNTY	RTE	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	CONST. ENGR.	TOTAL
M-52	IV	Alameda	5	A	Greenville	Livermore	4.33	6-11-24	W. A. Dontzwille	Conc. Shoulders	$ 56.[illegible]	$ 1,755	$ [illegible]
50	IV	Alameda	5	A	Greenville	Livermore	4.97	8-11-14	Perrott Bros. Co.	15 ft. Concrete Base	89,[illegible]	1,331	[illegible]
108	IV	"	5	A	Easterly Boundary	Altamont	6.00	10- 6-14	Pelzer & McAnyde	15 ft. Concrete Base	[illegible]	2,511	[illegible]
192	IV	"	5	A	Altamont	Greenville	3.68	7-13-17	Bates, Borland & Ayer	15 ft. Concrete Base	[illegible]	[illegible]	[illegible]
366	IV	"	5	A	Easterly Boundary	Greenville	9.99	5-24-22	Oakland Paving Co	Con.Shldrs. & Asph. Conc. Surf	[illegible]	11,500	[illegible]
D-91	IV	"	5	A	Greenville	Easterly Boundary	10.84	[illegible]- 4-15	Day Labor	Oiled Surfacing	[illegible]	35	[illegible]
D-338	IV	"	5	A	Altamont	Greenville	.21	5-12-20	Day Labor	Paving Gaps	[illegible]	[illegible]	[illegible]
D-421	IV	"	5	A	At Altamont		.08	1- 5-22	Day Labor	Paving Bridge Approaches	6,733	116	6,849
D-462	IV	"	5	A	Easterly Boundary	Greenville		5- 9-22	Day Labor	Guard Rail & Culverts	33,[illegible]	[illegible]	33,[illegible]
D-515	IV	"	5	A	Carrol Overhead Crossing			12- 5-22	Day Labor	Constructing Approaches	3,[illegible]	[illegible]	3,[illegible]
143	IV	"	5	B	Livermore	Santa Rita	5.82	7-20-15	H. G. Vaughn Const. Co	18 ft. Concrete Base	63,[illegible]	4,[illegible]	67,[illegible]
179	IV	"	5	B	Santa Rita	Dublin	3.34	5-22-17	Bates, Borland & Ayer	18 ft. Concrete Base	54,531	4,[illegible]	58,[illegible]
D-514	IV	"	5	B	At San Ramon Creek		.11	3- 4-20	Day Labor	Bridge Approach	2,770	241	3,011
311823	IV	"	5	B	Across Arroyo Las Positas, Tassajero & Alamo Creeks			7- 7-27	George J. Ulrich	R. C. Girder Bridges	[illegible]	2,[illegible]	[illegible]
312811	IV	"	5	B	Across Gull, Palocarsen and Hollis Creeks			11- 1-27	E. B. Skeels	R. C. Culverts & Wing Walls	45,663	3,437	49,100
M-168	IV	"	5	C	Livermore	Dublin	8.9	5-13-27	N. W. Ball	Grading & P. C. C. Pavement	343,231	10,133	353,[illegible]
61	IV	"	5	C	Hayward	Valle Vista School	3.12	4-22-14	Tieslau Bros.	18 ft. Concrete Base	40,[illegible]	2,[illegible]	43,[illegible]
230	IV	"	5	C	Overackers Corner	Southerly Boundary	8.40	7-19-18	O. G. Ritchie	18 ft. Concrete Base	169,[illegible]	7,[illegible]	177,[illegible]
D- 7	IV	"	5	C	Valle Vista School	Niles	6.21	11-19-14	Day Labor	18 ft. Concrete Base	[illegible]	2,[illegible]	[illegible]
D- 44	IV	"	5	C	Hayward	Niles	8.96	5-14-15	Day Labor	Oiled Surfacing	7,136	47	7,183
D-119	IV	"	5	C	S.P.R.R. Under Crossing		0.09	2-13-17	Day Labor	Concrete Base	1,133	[illegible]	1,[illegible]
D-401	IV	"	5	C	Station 500	Station 516	.30	10-20-21	Day Labor	Paving Exception	7,[illegible]	335	[illegible]
44803	IV	(Alameda)	5	C)	Warm Springs Junction	Milpitas	4.4	9-30-27	Allied Contractors Inc.	P. C. C. Pave & A. C. Surf	143,544	7,316	150,[illegible]
		(Santa Clara	5	A)									
62	IV	Alameda	5	D	Hayward	Oakland	5.06	4-22-14	Ransome Crummey Co	24 ft. Topeka Surface	65,431	3,211	68,[illegible]
		"			Various Locations	(9HE25)				Minor Improvements	3,357		3,357
		Alpine			Various Locations	(DM-73-34-131)(910EE5-6)				Minor Improvements	11,400		11,400
288	X	Amador	34	A	Westerly Boundary	Ione	5.86	5-10-21	J. Schmidt	24 ft. Grading	[illegible]	3,073	[illegible]
D-468	X	"	34	A	Westerly Boundary	Ione	5.33	5-25-22	Day Labor	Rock Surfacing	11,[illegible]	2	11,[illegible]
311701	X	"	34	A	Across Dry Creek			1-23-28	Holdenor Const Co	Timber Bridge	7,[illegible]	1,153	[illegible]
D-503	X	(Amador	34	B)	Clay	Jackson		4-30-24	Day Labor	Construct Guard Rail	1,[illegible]		1,[illegible]
		(Sacramento		A)									
299	X	Amador	34	B	Ione	Jackson	10.74	5-25-21	W. J. Schmidt	Grading	[illegible]	9,[illegible]	[illegible]
D-504	X	"	34	B	Ione	Jackson	10.74	10-19-22	Day Labor	Rock Surfacing	[illegible]	[illegible]	[illegible]
M-60	X	"	34	C	Jackson	Point 3 Miles East	2.62	1-14-25	R. N. Murdoch	Grading & Rock Surfacing	30,[illegible]	4,210	34,[illegible]
311823	X	"	34	C	About 1 Mile East of Jackson		1.1	1-13-28	G. D. Contoules	Grading	[illegible]	2,460	11,[illegible]
312801	X	"	34	C	East of Jackson		0.9	1-13-28	G. D. Contoules	Grading	4,033		4,033
394	X	"	34	A	Westerly Boundary	Central House	9.33	8-31-22	Blumenkranz & Vernon	Grading & Rock Surfacing	103,174	9,[illegible]	112,[illegible]
D-605	X	"	65	B	At Dry Creek Bridge			11-20-24	Day Labor	Grade Appr. to Dry Cr. Bridge	5,[illegible]	[illegible]	6,[illegible]
D-613	X	"	65	B	Central House	Dry Town	1.13	6-16-25	Day Labor	Grading & Rock Surfacing	[illegible]	1,[illegible]	[illegible]
		"			Various Locations	(CM-[illegible]-50-104-105-186-239-255)		(910EE21-24)		Minor Improvements	32,[illegible]		32,[illegible]
307	III	Butte	3	A	Southerly Boundary	Biggs	7.68	10-17-17	Municipal Imp. Co	15 ft. Concrete Base	116,475	7,507	123,[illegible]
D-341	III	"	3	A	Station 170+50	Station 300+50	.02	7-18-19	Day Labor	15 ft. Concrete Base	[illegible]		[illegible]
D-196	III	"	3	B	Biggs	Nelson	12.42	7-31-18	Day Labor	15' & 18' Concrete Base	510,[illegible]	15,162	525,[illegible]
454	III	"	3	B	At Cherokee Canal By-Pass			9-22-24	R. B. McKenzie	Reinforced Concrete Bridge	13,[illegible]	1,[illegible]	14,[illegible]
122	III	"	3	C	Nelson	Chico	12.77	2- 9-15	Whitlock & Gorrill	15 ft. Concrete Base	136,957	6,462	143,[illegible]
D- 92	III	"	3	C	4th St. Chapeantown	Little Chico Creek	.40	12-18-15	Day Labor	15 ft. Concrete Base	3,[illegible]	514	4,172
D-202	III	"	3	C	So. Appr. to Butte Cr. Bridge		.02	3-26-19	Day Labor	15 ft. Concrete Base	[illegible]		[illegible]
70	III	"	3	D	Linda Channel	Northerly Boundary	12.70	6- 9-14	P. L. Burr	15' & 18' Concrete Base	128,520	7,[illegible]	136,[illegible]
D- 87	III	"	3	D	Chico	Northerly Boundary	12.66	12- 4-15	Day Labor	911 Surface	[illegible]	[illegible]	[illegible]
D-357	III	"	3	D	Chico	Northerly Boundary	11.35	3- 8-21	Day Labor	Gravel Shoulders	6,[illegible]	[illegible]	6,[illegible]
227	III	"	31	A	Oroville	Shippee Road	6.38	7- 2-18	W. Blumenkranz	15 ft. Concrete Base	[illegible]	7,[illegible]	[illegible]
282	III	"	31	A	Across Feather R. near Oroville		.22	3-23-21	Healy-Tibbitts Const Co.	Steel Bridge	[illegible]	[illegible]	[illegible]

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

P-[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]			11-16-19	Day Labor	[illegible]		$ 691	$ 2,575
P-[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]			4- 8-20	Day Labor	Tool House		37	2,957
[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]			4-19-22	Day Labor	Guard Rail, St. Approach			822
P-[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]	[illegible]	[illegible]	1- 3-21	W. A. Kettlewell & Sons	Grading & 15' Concrete Base		1,117	101,389
				A	[illegible]	[illegible]	[illegible]	1-13-22	Day Labor	Rock Surf. & 15' Conc. Pave.		1,204	44,979
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	17	A	[illegible]	[illegible]	[illegible]	4-[illegible]	Chico Contracting Co.	Asphalt Concrete Pavement		4,858	39,422
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Minor Improvements		693	14,030
[illegible]	[illegible]	Calaveras	24	A	[illegible]	[illegible]	[illegible]	7-[illegible]	Frank C. McIntire	Grading		6,193	77,332
P-[illegible]	[illegible]	[illegible]	24	A	[illegible]	[illegible]	[illegible]	[illegible]	Day Labor	Rock Surfacing		[illegible]	26,995
P-[illegible]	[illegible]	[illegible]	24	A	[illegible]	[illegible]	[illegible]	[illegible]	Prison Labor	Grading		970	60,858
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Colusa	[illegible]	A	[illegible]	[illegible]	[illegible]	[illegible]	C. L. School	15 ft. Concrete Base		[illegible]	120,458
[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]	[illegible]	[illegible]	[illegible]	Clark & Heaney Const. Co.	22.5 ft. Topeka Surfacing		216	5,303
[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]	[illegible]	[illegible]	[illegible]	Day Labor	Oiled Surfacing		168	2,765
[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]	[illegible]	[illegible]	[illegible]	Day Labor	Oiled Surfacing		[illegible]	8,129
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	C. L. School	15 ft. Concrete Base		[illegible]	146,467
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	A	S.P. [illegible] Colusa & Lake R.R.	[illegible]	[illegible]	[illegible]	Day Labor	15 ft. Concrete Base		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	B	Berlin	Colusa Junction	[illegible]	[illegible]	Day Labor	Oiled Surfacing		95	13,980
[illegible]	[illegible]	[illegible]	[illegible]	B-C	Williams	[illegible]	[illegible]	[illegible]	Hemstreet & Bell	Rock Borders		983	33,158
[illegible]	[illegible]	[illegible]	[illegible]	C	Colusa Junction	Monterey Boundary	[illegible]	[illegible]	L. F. Gerstenz	15 ft. Concrete Base		[illegible]	101,457
P-[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Stn. [illegible] (Exc.)	[illegible]	[illegible]	[illegible]	Day Labor	15 ft. Concrete Base		181	802
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
P-[illegible]	[illegible]	[illegible]	[illegible]	2	Colusa Junction	County Line	[illegible]	[illegible]	Day Labor	Oiled Surfacing		[illegible]	16,754
[illegible]	[illegible]	[illegible]	[illegible]	2	Across Grand Canal, Corral Creek & Parks Slough	[illegible]	[illegible]	[illegible]	Noble Bros.	Reinf. Conc. Bridges		1,213	23,565
[illegible]	[illegible]	[illegible]	[illegible]	7-15	In and East of Williams	[illegible]	[illegible]	[illegible]	J. A. Costello, Jr.	Asphalt Concrete Surfacing		[illegible]	12,943
[illegible]	[illegible]	[illegible]	15	A	Williams	[illegible]	[illegible]	[illegible]	C. W. Cross	15 ft. Concrete Base		[illegible]	111,661
[illegible]	[illegible]	[illegible]	15	A	Williams	[illegible]	[illegible]	[illegible]	Day Labor	Oiled Surfacing		84	12,682
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
P-359	III	[illegible]	15	A	Sta. 140	Sta. 176	[illegible]	[illegible]	Day Labor	18' Conc. Pave. 1st Story		431	21,320
393	III	Colusa-Butte	15	B-A	Colusa	Long Bridge	[illegible]	[illegible]	Bonnell, Swingle & Fox	18' Concrete Pavement	[illegible]	[illegible]	297,093
456	III	Colusa	15	B-E	Knights Ranch	Williams	[illegible]	[illegible]	Giddings & Lyte	Grading Road Widening		4,652	84,581
VILC1	III	[illegible]	15	[illegible]	1/2 Mi. N. & Pinehurst Dr.	Williams	[illegible]	[illegible]	E. F. Hillyard	Oil treating Surfacing		[illegible]	6,980
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Various Locations	(M-157)	[illegible]	[illegible]	[illegible]	Minor Improvements		[illegible]	2,001
91	IV	[illegible]	[illegible]	A	San Pablo Creek	[illegible]	[illegible]	[illegible]	J. H. Fallmer	Grading		[illegible]	26,619
130	IV	[illegible]	[illegible]	A	Rivermont	Alameda	[illegible]	[illegible]	Bates, Borden & Ayer	16' & 18' Concrete Base		[illegible]	52,832
170	IV	[illegible]	[illegible]	A	[illegible] Overpass	[illegible]	[illegible]	[illegible]	Blanchard, Drew & Co.	20' Topeka on Concrete Base		[illegible]	54,480
P-[illegible]	IV	[illegible]	[illegible]	A	30[illegible] Iron Pipeline Co.	[illegible]	[illegible]	[illegible]	Day Labor	Culverts		147	1,801
[illegible]	IV	[illegible]	[illegible]	A	Rivermont	[illegible]	[illegible]	[illegible]	Day Labor	Oiled Surfacing		111	4,365
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
P-[illegible]	IV	[illegible]	[illegible]	A	At San Pablo & [illegible] Cut Bridge	[illegible]	[illegible]	[illegible]	Day Labor	Wing Walls on Bridges		213	534
[illegible]	IV	[illegible]	[illegible]	A	Across Grunsky Slough	[illegible]	[illegible]	[illegible]	John Phillips	Reinforced Concrete Bridge		1,116	5,806
[illegible]	IV	[illegible]	[illegible]	A	Across San [illegible]	[illegible]	[illegible]	[illegible]	R. B. McKenzie	Concrete Bridge		[illegible]	22,499
[illegible]	IV	[illegible]	[illegible]	A	Thru El Cerrito	[illegible]	[illegible]	[illegible]	State's Same	Improve San Pablo Ave.		[illegible]	34,995
[illegible]	IV	[illegible]	[illegible]	A	Across Rile Cut Bridge	[illegible]	[illegible]	[illegible]	Atlas Const. Co.	Reinforced Concrete Bridge		1,087	17,154
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	IV	[illegible]	[illegible]	A	At Rile Cut Bridge Approach	[illegible]	[illegible]	[illegible]	Dreisbach Bros.	Grade & Surface App.		1,109	8,385
[illegible] 75	IV	[illegible]	[illegible]	A-B	San Pablo Creek	El Cerrito	[illegible]	[illegible]	Kaiser Paving Company	Bit. Mac. Surf. & Widening		[illegible]	166,623
103	IV	[illegible]	[illegible]	B	Eckley	Martinez	[illegible]	[illegible]	Bates, Borden & Ayer	Grading		[illegible]	67,677
141	IV	[illegible]	[illegible]	B	El Cerrito [illegible]	Eckley	[illegible]	[illegible]	Bates, Borden & Ayer	Grading		[illegible]	50,727
201	IV	[illegible]	[illegible]	B	Hercules	Eckley	[illegible]	[illegible]	Whitlock & Farrell	15' Concrete Base		[illegible]	82,212
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
411	IV	[illegible]	[illegible]	[illegible]	Station [illegible]	[illegible]	[illegible]	[illegible]	Louis Tagino	Grading & Rock Surfacing		[illegible]	43,853
P-153	IV	[illegible]	[illegible]	[illegible]	Eckley	Martinez	[illegible]	[illegible]	[illegible] Labor	15' Concrete Base		[illegible]	117,584
P-209	IV	[illegible]	[illegible]	[illegible]	At Vallejo	[illegible]	[illegible]	[illegible]	[illegible] Labor	Concrete Retaining Wall		[illegible]	14,345
P-[illegible]	IV	[illegible]	[illegible]	[illegible]	Hercules	Vallejo	[illegible]	[illegible]	[illegible] Labor	Guard Rail		[illegible]	18,031
P-411	IV	[illegible]	[illegible]	[illegible]	Station [illegible]	Station [illegible]	[illegible]	[illegible]	[illegible] Labor	15' Concrete Base		272	595

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

[illegible]	Dist.	County	Rte.	Sec.	Road	To	Length	Date Accepted	Contractor	Type of Work	Contract Price	Extra Work	Total
[illegible]	IV	[illegible]	24	B	At Walnut Grove			6-21-27	Day Labor	Construction, Drainage	$ [illegible]	$ 19	$ [illegible]
[illegible]	IV	" "	24	B	El Dorado	Walnut	1.9	10-1-27	Thurston Bros.	Grading & Rock Surfacing	[illegible]	14,695	[illegible]
[illegible]	IV	" "			Various Locations (SM-[illegible])					Minor Improvements		30	
[illegible]	IV	[illegible]	1	A	Mokelumne River Crossing			11- 9-21	Day Labor	Temporary Bridge		26	
[illegible]	IV	[illegible]	1	A	Mokelumne River Bridge			7- 9-27	Day Labor	Tent Bunkhouse		45	1,[illegible]
[illegible]	IV	" "	1	A	[illegible] Creek	Hunter Creek	1.70	7-21-27	Prison Labor	Grading	[illegible]	16,339	[illegible]
[illegible]	IV	" "	1	A	Mokelumne River Bridge			4- 7-28	Day Labor	Foundation of Piles	1,[illegible]	597	1,[illegible]
[illegible]	IV	" "	1	A	[illegible] Flat - Upper	Mokelumne River		6-12-28	F. Reynolds	Raised Grade Bridge	[illegible]	[illegible]	[illegible]
[illegible]	IV	" "	1	A	[illegible] Flat - Upper	Mokelumne River		1-10-25	H. W. Roll	Planking Deck Superstructure	11,[illegible]	1,712	1[illegible]
[illegible]	IV	" "	1	A	Mokelumne River Br.	Mokelumne River	0.0	1- 3-27	Day Labor	Slide Removal	[illegible]		[illegible]
[illegible]	I	" "	1	A	At Kingvale, S. P.			8-22-27	Day Labor	Rip Rap	19,9[illegible]	1,548	21,496
[illegible]	I	" "	1	A,B	At Kingvale Truck Bridge			11-20-23	Day Labor	Grade Approaches	749	2	751
[illegible]	I	" "	1	A,B	Wilson Creek		.02	7-23-26	O.H. Gilderleeve	Reinforced Concrete Culvert Br.	8,952	486	9,438
[illegible]	I	" "	1	B	Wilson Creek	Cushion Creek	10.91	7- 2-19	Polsley & McBryde	Grading	548,127	42,517	590,644
[illegible]	I	" "	1	B	Cushion Creek	Crescent City	4.08	10-13-19	Polsley & McBryde	Grading	27,741	2,880	30,621
[illegible]	I	" "	1	B	Cushion Creek	Crescent City	4.08	8-13-20	Day Labor	Rock Surfacing	24,732	728	25,460
[illegible]	I	" "	1	B	Cushion	Crescent City	4.08	6-21-21	Day Labor	Concrete Retaining Wall & Culverts	11,074	229	11,303
[illegible]	I	" "	1	B	Wilson Creek	Last Chance Slide	3.18	4-25-22	Day Labor	Rock Surfacing	16,581	465	17,046
[illegible]	I	" "	1	C	Across Smith River			5- 7-26	Smith Bros. Co.	Concrete Bridge	141,428	3,014	144,442
[illegible]	I	" "			Various Locations (SM-[illegible])					Minor Improvements	30,[illegible]	247	30,691
[illegible]	[illegible]	El Dorado	11	A	White Rock	Sample Sections	10.28	11-29-17	Prison Labor	12 ft. Concrete Base	250,760	7,360	258,120
[illegible]	[illegible]	" "	11	B	Shingle Springs	El Dorado	6.57	8-27-13	Day Labor	12 ft. Oiled Macadam	97,595	4,628	102,021
[illegible]	[illegible]	" "	11	C	El Dorado	Placerville	4.57	4-22-14	Day Labor	12 ft. Conc. Base Oiled Surf.	160,834	4,808	165,642
D-405	[illegible]	" "	11	E	Five Mile House	Camino	2.37	10-20-21	Day Labor	Grading & Rock Surfacing	21,423	566	21,989
D-441	[illegible]	" "	11	E	Five Mile House	Camino	2.37	6-11-23	Day Labor	15 ft. Asphalt Macadam Surfacing	15,333	3	15,336
M-81	III	" "	11	E,F	Camino	2 Mi.E.Sportsmans Hall	5.77	5-20-25	Irey & Holden	Grading & Rock Surfacing	69,258	5,340	74,498
M-127	III	" "	11	F	2 Mi.E.Sportsmans Hall	Riverton	9.56	5-15-26	Irey & Holden	Grading & Rock Surfacing	56,591	4,728	61,319
9[illegible]	III	" "	11	F	Sportsmans Hall	Riverton		9-15-27	States Share	Grading	50,000		50,000
9[illegible]	III	" "	38	B	At Emerald Bay			7- 9-27	Day Labor	Retaining Wall	10,353	625	10,978
D-M-55	III	" "	38	B,C	Tallac	McKinneys	8.00	4-15-25	Day Labor	Grading	37,636	1,912	39,548
M-102	III	" "	38	B,C	Tallac	Northerly Boundary	3.50	4- 3-26	Day Labor	Grading	47,018	2,347	49,365
M-380	III	El Do.- Pla.	38	B,C,A	Tahoe City	Tallac	8.00	3- 9-27	Day Labor	Grading & Rock Surfacing	31,312	2,072	33,384
9382	III	" "	38	C-A	Sec. 35E, III-Pla.-12-A,C								
	III	El Dorado			Various Locations (SM-181-19[illegible]-216-B,C) (53EE4-[illegible])					Minor Improvements	25,259	856	26,114
48	VI	Fresno	4	A	Fowler	Kingsburg	8.21	11-21-13	A. Teichert & Son	15 ft. Conc. Base-Oiled Surfacing	72,034	4,625	76,659
[illegible]	VI	" "	4	A	Selma	Kingsburg	3.71	12- 6-21	California Const. Co.	Conc.Shldrs & Asph.Surfacing	74,921	1,513	76,434
47	VI	" "	4	B	Fowler	Fresno	7.97	11-21-13	A. Teichert & Son	20 ft. Conc. Base Oiled Surfacing	91,288	3,193	94,481
120(M-53)	VI	" "	4	B	Malaga	Fresno	2.69	11-19-17	Blanchard,Brown & Co.	Topeka Surfacing	22,748	3,412	26,160
D-312	VI	" "	4	B	Intersn.Jensen Ave.,Sta. 32[illegible]+76 to Sta. 36[illegible]+66		.02	3- 4-30	Day Labor	Bituminous Pavement	230		230
D-401	VI	" "	4	B	Intersn.Chestnut Ave. & Southern Pacific Ry.			10- 4-22	Day Labor	Asphaltic Concrete Base	327		327
D-260	VI	" "	4	B,C	Van Ness Blvd. & Belmont Avenue Intersection			9- 2-19	Day Labor	Concrete Base Macadam Surfacing	1,[illegible]0		1,150
M-140	VI	" "	4	B	Chestnut Avenue	Chestnut Avenue	0.6	8-28-26	Calif.Rd. & Street Const.Co.	A.C.Widening & Surfacing	17,[illegible]10	1,239	18,[illegible]
8	VI	" "	4	C	Fresno	Herndon	9.56	8-27-12	Wadsworth St.Pave.Co.	15 ft. Conc.Base Oiled Surf.	66,[illegible]13	3,100	69,[illegible]
342	VI	" "	4	C	Fresno	0.3 Mi. Northwesterly	0.27	11-29-21	Federal Const. Co.	Asphaltic Concrete Surfacing	38,[illegible]10	891	39,[illegible]
M-49	VI	" "	4	C	2 Mi. N. of Fresno	Herndon	5.9	4-15-25	Stewart & Bland	P.C. Concrete & Rock Borders	54,133	2,691	56,824
M-94	VI	" "			At Fresno			7-29-26	J. P. Williams	Maintenance Shop Building			32,[illegible]0
409	VI	" "	10	C	Porterville Junction	Coalinga	6.64	12-14-22	C. Miles	Grading	117,[illegible]31	11,[illegible]52	129,[illegible]83
245	VI	" "	10	D	Coalinga	Oil City School	9.06	6-18-19	Joseph G. Donovan	18 ft. Concrete Base	248,797	3,[illegible]99	252,[illegible]96
D-337	VI	" "	10	D	Coalinga	Oil City School	9.06	5- 6-20	Day Labor	Moving Concrete Aggregate	415		415
376	VI	" "	10	E	Oil City School	Huron Road	12.00	3- 3-21	Guy F. Atkinson	15' Concrete Base	403,603	10,003	413,[illegible]6

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

Contract Number	Dist.	County	Rte.	Sec.	From	To	Length Miles	Contract Date	Contractor	Type of Work	Contract Price	Amt. Engr.	Cost
275	VI	Fresno		F	Huron Road	Easterly Boundary	8.01	5- 4-21	Bates & Borland	18' Concrete Base	$ 215,143	$ 5,811	$ 220,140
379	VI	"		F	At Sta. [illegible] & 84+26		15	8-25-21	Day Labor	Bridge Approaches	1,008		1,008
229	VI	Fresno-[illegible]			Various Locations Route 4				Day Labor	Drainage Improvements	9,726	56	9,782
504	VI	Fresno			Fresno Office Bldg.			1-24-23	Shorb & Neale	Division Office Building	22,787	1,526	24,313
505	VI	"			Fresno Office Bldg.			6-26-22	Barrett Hicks Co	Plumbing & Heating, Office Bldg	3,194	45	3,239
436	VI	"			Fresno Office Bldg.			10-25-26	Day Labor	Improve Grounds around Bldg.	2,042	156	2,198
11	III	Glenn		A	Southerly Boundary	Willows	8.50	11-20-14	C.W. Cross	15 ft. Concrete Base	75,456	4,871	81,327
254	III	"		A	County Line	Willows	4.38	9-23-19	Day Labor	Oiled Surfacing	6,550	100	6,650
43	III	"		A	Southerly Boundary	Logandale	5.60	5- 8-22	Day Labor	20 ft. Oiled Macadam	83,081	2,045	85,126
436	III	"		A,B	Adjoining Town of Willows		.66	1-18-22	Day Labor	18 ft. Concrete Base	15,321	1,010	16,331
194	III	"		B	Willows	Grapit	9.43	7- 7-15	Taylor & Berliner	15 ft. Concrete Base	73,844	4,504	80,348
17	III	"		B	At Walker Creek		1.04	7-10-16	M.Jacinto & A.L. DeRoza	15 ft. Concrete Base & Bridge	13,867	956	14,823
39	III	"		B	Walnut Creek Br. Approx.		.24	5-26-19	Day Labor	15' & 21' Concrete Base	902	158	1,060
258	III	"		B	Willows	Grapit	10.44	9-23-19	Day Labor	Oil Surfacing	16,179	66	16,245
402	III	"		B	Across Wilson Creek			9-30-27	Gersain & Hickles	Reinf. Conc. Girder Bridge	7,400	733	8,133
7	III	"		C	Grapit	Northerly Boundary	6.96	6- 9-14	P.H. Hoare	15 ft. Concrete Base	58,163	2,755	60,918
90	III	"		C	Across Stonyright Creek		.30	6-10-21	Jenkins & Elton	Concrete Bridge	9,923	851	10,774
53	III	"		C	At Stony Creek			11- 2-21	Jenkins & Elton	Bank Protection	8,358	692	9,050
70	III	"		C	Grapit	Northerly Boundary	6.94	8-24-15	Day Labor	Oil Surfacing	4,393	243	4,636
419	III	"		C	At Stonyright Creek Br			11-17-21	Day Labor	Concrete Base & Guard Rail	584		584
29	III	"	45	A,B	Willows	3 Mi. So. of Glenn	11.89	12-14-22	V.R. Dennis Const. Co.	Grading & Rock Surfacing	153,921	2,786	156,707
162	III	"	45	B	Four Corners	Butte City	1.1	10- 3-27	Clay K. Buchanan	Bit.Mac.Surf. & Rock Borders	11,572	515	11,887
16	III	"	45	C	Butte City	East Co. Boundary		7-30-26	Day Labor	Two Timber Bridges	6,176	56	6,232
99	III	"	45-7	A	At Central Irr. Canal			1- 3-25	Otto Parlier	Two Concrete Culverts	18,182	1,390	19,572
41	III	"	47	A	Across Stony Creek		.19	1- 4-23	A.W. Kitchen	Steel & Conc. Bridge	113,581	4,901	118,482
508	III	"	47	A	At Stony Creek Bridge			9-24-24	Day Labor	Approaches to Bridge	3,941	575	4,516
1061	III	"	47	A	Orland	Hamilton City		5-23-28	L.J. Nipp	Widening & Raising Grade	6,160	7	6,167
	III	"			Various Locations	(DM-71)			Day Labor	Minor Improvement	6,574	763	7,137
41	I	Humboldt	1	A	Garberville	Sec.1, T.5 S., R.1 E	5.48	10-29-13	Fairbanks & Baechtel	Grading	52,466	2,463	54,929
60	I	"	1	A	Sec. 1, T. 1 S., R.3 E	Southerly Boundary	4.98	4-22-14	Berry, Mackie & Co.	Grading	64,725	1,984	66,709
245	I	"	1	A	At So. Fork Bridge			8-15-19	Day Labor	Grading Approaches	1,762	34	1,796
483	I	"	1	A	Southerly Boundary	Garberville		1- 5-22	Day Labor	Rock Surfacing	6,745		6,745
387	I	(Humboldt)	1										
		(Mendocino)	1	22.5	Willits	Dyerville		9- 7-21	Day Labor	Widening Roadway	25,310	1,133	26,443
211	I	Humboldt	1	B	Garberville	Miranda	15.61	11-19-17	Palmer & McBryde	Grading	273,339	14,133	287,472
316	I	"	1	B	Across Near Dutch		.34	7-30-21	Frank H. Green	Concrete Bridge	45,790	1,403	47,193
420	I	"	1	B	Station 1[illegible]+00	Station 450+00	4.95	9- 3-19	Day Labor	Graveling	21,263		21,263
429	I	"	1	B	At Sta. 4, & Dean Cr			10-15-19	Day Labor	Bridges	17,803	134	17,937
93	I	"	1	C	Miranda	Dyerville	13.75	8-11-14	Fairbanks & Baechtel	Grading	160,474	7,034	167,508
464	I	"	1	C,D	Miranda	Jordan Creek		5-17-22	Day Labor	Widen. & Rock Surfacing	263,748	5,683	269,431
80	I	"	1	E,D				5-20-26	R.Zelinsky	Clean & Paint 5 Bridges	42,402		42,402
71	I	"	1	D	Dyerville	Shively	7.23	6- 9-14	F. Smith & O.W. Somers	Grading	102,669	5,622	108,291
104	I	"	1	D	Shively	Jordan Creek	3.85	10- 6-14	Wm.Crowley & T.P. Cloney	Grading	38,923	2,225	41,148
155	I	"	1	D	Station [illegible]	Station 194+00	.37	9-13-17	Day Labor	Grading	4,628		4,628
71	I	"	1	E	At Eel River Bridge			4-15-25	Henry Padgett	Sidewalk & Pavement	25,329	764	26,093
136	I	"	1	E	Jordan Creek	Rio Dell	6.92	6- 2-15	Bates,Borland & Ayer	Grading	68,007	3,556	71,563
101	I	"	1	D	Along the Eel River	Near Pepperwood			Fred J.Maurer & Son	Bank Protection	7,376		7,376
166	I	"	1	E	Across Eel River near Scotia		.19	4-25-16	Mercer, Fraser Co.	Steel Bridge	120,407	1,214	121,621
300	I	"	1	E	Station [illegible]	Station 134+16	2.54	9-22-20	Day Labor	Grading	5,102	101	5,203
281	I	"	1	E,F	So. Scotia Bridge	Fortuna	12.03	5-23-21	Mercer, Fraser Co.	15' & 18' Concrete Base	277,466	4,634	282,100

[illegible] NUMBER	DIST	COUNTY	RTE	SEC	FROM	TO	LENGTH MILES	DATE OF [illegible]	[illegible]	TYPE OF WORK	[illegible]	[illegible]	TOTAL
D-[illegible]	1	Humboldt	[illegible]	S.F	Except[illegible]		1.00	[illegible]	Day Labor	Paving Excavations	$ 27,996	$ [illegible]	$ 28,529
D-[illegible]	1	[illegible]	[illegible]	F	Across Van Duzen River			10- [illegible]	Day Labor	Emergency Detours	12,308	[illegible]	12,636
[illegible]40	1	"	[illegible]	F	Across Van Duzen R[illegible]ver Alton			[illegible]	Bonsall & Dougherty	Reinforced Concrete Bridge	106,299	[illegible]	111,481
[illegible]05	1	"	1	F	Rio Dell	Fortuna	0.51	9-18-17	A.Swanson & [illegible]	Grading	46,695	[illegible]	49,953
D- 27	1	"	1	F	2-1/2 Mi.N.of Rio Dell	1/4 Mi.S. Alton	.32	11-31-15	Day Labor	Grading	12,626	[illegible]	13,490
D-216	1	"	[illegible]	F	Van Duzen St. Rr. Extension		.15	2-21-19	Day Labor	Timber Bridge	1,161		1,161
D-536	1	"	[illegible]	F	Van Duzen Riv Bridge			5-14-23	Day Labor	Test Borings	2,600		2,600
105	1	"	1	J	Loleta	Beatrice	4.30	10- 6-14	Eisemann & Jacobs	Grading	24,307	[illegible]160	26,467
[illegible]41	1	"	1	J	Loleta	Beatrice	4.30	7-10-16	Eisemann & Jacobs	15 ft. Concrete Base	36,932		36,932
340	1	"	1	J	Across Eureka Slough		.13	8-26-19	Mercer, Fraser Co.	Timber Bridge	81,212	2,696	83,908
D-275	1	"	1	J	Eureka	Eureka	7.94	10-15-19	Day Labor	15 ft. Concrete Base	294,566	12,584	307,150
517	1	"	1	J	Fortuna	Loleta	2.06	12-10-20	Kaiser Paving Co	Grading & Rock Surfacing	89,299	8,364	98,663
D-[illegible]14	1	"	1	J,K	Eureka	Arcata	6.67	6-24-22	Day Labor	Grading & Rock Borders	25,519	1,612	27,131
[illegible]11	1	"	1	J,K	Eureka	Arcata	6.5	7-11-24	J.F. Kragg	P.C. Concrete Pavement	252,375	15,361	267,736
320	1	"	1	K	Eureka	Arcata	6.17	3-13-18	Mercer Fraser Co	Grading	97,608	8,294	105,902
D-[illegible]60	1	"	1	K	Eureka	Arcata	6.20	3-22-21	Day Labor	Rock Surfacing	72,960	1,350	74,310
D-[illegible]61	1	"	1	K	In the City of Arcata		.40	10- 8-23	Day Labor	20 ft. Concrete Pavement	15,914	62	15,976
[illegible]68	1	"	1	I	Mad River	Trinidad	10.64	5-25-21	A. J. Fairbanks	Grading	229,792	19,725	249,517
D-[illegible]45	1	"	1	I	S. 19, T.7 N. R.1 E	Strawberry Creek	.96	9- 8-20	Prison Labor	Grading	18,524	1,699	20,223
D-[illegible]18	1	"	1	I	Near Mad River			12- 7-21	Day Labor	12" Tile Drain	1,840		1,840
D-[illegible]82	1	"	1	I	Mad River	Trinidad	6.51	7-26-22	Day Labor	Rock Surfacing	39,597	320	39,917
D-[illegible]80	1	"	1	I	At Mad River			6-11-23	Day Labor	Test Borings	2,150		2,150
[illegible]46	1	"	1	J	Freshwater Lagoon	Orick	2.80	7-28-19	J.Wilsamurst & J. F Reddy	Grading	44,406	4,548	48,954
377	1	"	1	J	Trinidad	Freshwater Lagoon	16.53	6-29-22	Pacific Const. Co	Grading & Rock Surfacing	570,033	39,282	609,315
D-[illegible]24	1	"	1	J	Trinidad	Freshwater Lagoon	16.53	5-21-24	Day Labor	Crush & Stockpiling Rock	20,228		20,228
[illegible]00	1	"	1	J	Across Big Lagoon		1.4	1-29-26	Mercer Fraser Co.	Timber Trestle-Grading, Surf	149,227	5,524	154,751
D-[illegible]38	1	"	1	K	Orick	Northerly Boundary	14.9	4-13-27	Engelhart Paving &Const Co.	Clearing Right of Way	99,606	1,823	101,429
W- 39	1	(Humboldt	1)					10- 8-23	Chas. L. Kaet	Painting 17 Bridges			12,236
		(Mendocino	)										
D-309	1	Humboldt	20	2,2	Redwood Creek	Easterly Boundary	35.00	2-26-30	Prison Labor	Grading	633,273	18,739	652,012
	1	"			Various Locations (DM-37-83-37-95-97-114-196-198-201-202) (91E2-3-e)					Minor Improvements	50,919	107	51,026
127	VIII	Imperial	12	A	Myers Creek	Coyote Wells	6.02	10- 6-14	J.W. Calcaok	15 ft. Concrete Base	105,953	6,665	112,618
D-[illegible]79	VIII	"	12	A	Across Myers Creek		.06	11-23-15	Holland Const Co	Concrete Bridge	33,570	2,529	36,099
D-[illegible]13	VIII	"	12	A	San Diego & Arizona R.R. Crossing			3-30-16	Day Labor	Abutments for Under Crossing	12,614	35	12,649
D-[illegible]27	VIII	"	12	A	Myers Creek	Coyote Wells		7-31-16	Day Labor	Constructing Detours	2,070	32	2,102
D-[illegible]26	VIII	"	12	A	Myers Canyon Grade		5.11	1-14-20	Day Labor	Widening	19,471	308	19,779
482	VIII	(Imperial	12	A)	(See Cont 482 San Diego-Imperial 12-H-A)								
		(San Diego		H)									
515	VIII	(Imperial	12	A)	(See Cont 515 San Diego-Imperial 12-H-A)								
		(San Diego		H)									
[illegible]832	VIII	Imperial	12	A	Myers Creek	3 Mi.W.of Coyote Wells	2.3	10-13-27	Ward & Gaeler	Grading	49,728	2,710	52,438
116	VIII	"	12	B	Coyote Wells	Dixie Land	11.74	12- 8-14	Rice & Dutcher	15 ft. Concrete Base	111,536	5,481	117,017
161	VIII	"	12	C	Dixie Land	El Centro	11.67	12-12-15	Fred Hoffman	15 ft. Concrete Base	104,998	4,920	109,918
178	VIII	"	12	C	New River Bridge		.06	2- 6-17	Mercereau Brg.Const.Co.	Concrete Bridge	19,550	1,610	21,160
D-183	VIII	"	12	C	New River Bridge		.26	1-31-18	Day Labor	Grading	2,663	79	2,742
D-223	VIII	"	12	C	Approaches to New River Bridge		.26	3-26-19	Day Labor	15 ft. Concrete Base	6,861	82	6,943
911[illegible]04	VIII	"	12	J	Across New River	Near Seeley		11- 1-27	W.M.Ledbetter & Co	Bridge Repairs	10,349	1,232	11,581
911[illegible]05	VIII	"	12	J	Across Bullhead Slough & West Main Canal			11-10-27	Pioneer Transfer Co	Timber Bridges	13,155	883	14,038
D-288	VIII	(Imperial	12	H	Westerly Boundary	Mountain Springs	2.93	11- 6-19	Day Labor	Grading and Concrete Base	84,249	2,820	87,069
		(San Diego		)									
430	VIII	Imperial	8	A	Westmoreland	4 Miles West	3.93	11-26-23	Pioneer Transfer Co	Grading & Rock Surfacing	46,312	5,076	51,388

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

			36	A	Station 0+72 Sec. A	Station 76+00 Sec. B			Day Labor	8" A. C. Concrete Base			
			36		Kane Springs	Dyer Road	11.0		Day Labor	8" A. C. Concrete Base			
			36		Bridges and Culvert Work				T.W. [illegible] & Co.	Timber Bridge		513	
			36	E	Shoshone Mountain	Dyer Road	0.86		Day Labor	Crushed Base		980	
			36	F	El Portal	Imperial	0.00		J.F. [illegible]	24' CC Concrete Pavement		912	
			39	F	Imperial	El Centro	0.0		Day Labor	Shoulder & Approach Surfacing		276	
			39	F	Adams Avenue	North Park Limits	0.0		[illegible]	Grading & Gravel Surfacing		1,015	
			39	F,G	Imperial	Brawley	0.0		[illegible]	Grading & Gravel Surfacing		0.175	
			39	G	1.2 Mi. N. of Escondido and	Escondido-Oceanside			Day Labor	Grading & Gravel Surfacing		412	
			39	G	In Escondido				Day Labor	24' Concrete Pavement		1,506	
			16	A	San Mateo, Redwood & Trifolium Channel				Norman B. Downey	Treated Timber Planking		589	
			16		Redwood	Metropolitan	1.00		P.J. [illegible]	Grading & Gravel Surfacing		0.511	
			16-27		Grand, Lakeside, Highline Canals & Alamo Flow				W.W. Ledbetter & Co	Penal Timber Bridges		3,111	
			27	A	Bard Gish Lateral	San Cayetano Creek	0.8		George H. Dowd	Grading & Gravel Surfacing			
			27	A	Ventura County Work	Santa Co. Well [illegible] Phase B			Downey & Dowd	Grading & Gravel Surfacing		6,887	
			27	A	Main Line, Canal	1 Mile East	1.00		Day Labor	24' CC Concrete Pavement		911	
			27	A	Sheldon Tunnel	Sheldon Tunnel	0.25		Day Labor	Grading			
			27	B	Grade Hills	Simpsonite Mines	1.02		Klinselburg Schmidt & Hitchcock	Grading & Gravel Surfacing		734	
			27		Sheldon Tunnel, Canal & Power Structure				W.M. Ledbetter Co.	Timber Trestles		135	
			27	B	At Grade Separations		0.38		Day Labor	Plank Decks		159	
			27	B	In Open Valley				Day Labor	Gravel Surfacing			
			27	B	Sheldon, Channel	Simpson Mineral	0.10		Day Labor	Gravel Surfacing		113	
			27	B	Arteries from Grade Hills		0.95		Schmidt & Hitchcock	Grading & Gravel Surfacing		995	
			27		El Centro	Agricultural	0.00		G.Y. Faucett	Grading & Gravel Surfacing		822	
			27	D	Mutual No. 1	East Side Line Canal	0.80		Norman B. Downey	Grading & Gravel Surfacing		869	
					Various Locations	(EM-57-[illegible]-231-[illegible])				Minor Improvements		75	
					Various Alignment	Various Towns				Grading		157	
					Improvement	Various Towns				Grading		794	
			23	A	Independence Creek	Fish Springs School	11.0		Day Labor	Grading & 24' Concrete Base		1,518	
			23		Fish Springs School	S.E. [illegible] T 8 S. R 31 E.	11.0		Redmond, Page & Pond	Grading		5,841	
			23	D	S.E. Cor. Sec. 33, T 7 S. R 31 E. Diamond		11.00		Nevada Const. Co	Grading		713	
			23		Station 730	Station 744			Day Labor	Chemical Stitcher		119	
			23	E	Bishop	Round Valley Road	0.17		A.L. Grier	18 ft. Bituminous Macadam		417	
			23	F	Round Valley	Northerly Boundary	0.5		Day Labor	Grading		701	
	IX	Inyo - Kern			See W-and Kern-Inyo-23-D,E,F								
	IX	Inyo	23	H,I	Keno Junction	Olancha	31.3		F.O. Payton	Grading		4,163	
	IX	"	23	K	At Station Mined				Day Labor	Reinf. Conc. Box Culvert			
	IX	"			At Bishop				Stuart T. Johnson	Maintenance Bldg.			
	IX	"			Various Locations	(EM-57-[illegible]-230-[illegible]) (7774)				Minor Improvements		1,086	
	VI	Kern	4	A	Southerly Boundary	0.3 Mi. S. Rose Sta.	10.37	10- -14	A.C. McLean Const. Co	Grading		9,258	
	VI	"	4	A	Southerly Boundary	0.3 Mi. S. Rose Sta.	7.66	9- -15	Day Labor	Oiling Graded Road		289	
	VI	"	4	A	Southerly Boundary	0.3 Mi. S. Rose Sta.	10.74	8- -14	Day Labor	20 ft. Concrete Base		4,353	
	VI	"	4	A	Lerdo	Bena View	12.8	4- -14	Day Labor	Widening & Daylighting			
	VI	"	4	B	Tehachapi Creek	Sec 5&6 T 32 S. R.2 E	17.29	8-28-14	Owen B. Atkinson	15 ft. Concrete Base		9,734	
	VI	"	4	B	Tehachapi Creek	Station 412+97	17.18	10- -14	Southwest Paving Co.	15' & 20' Asph. Conc. Surf			
	VI	"	4	B	Tehachapi Creek	Sec 5&6 T 32 S. R.2 E	17.29	1- 7-15	Day Labor	Oil Surfacing			
	VI	"	4	B	Station 382+17	Station 412+97	2.80	8-29-14	Day Labor	20' Conc. Pave. 2nd Stage		481	
	VI	"	4	B	Tehachapi Creek	Station 195+36	6.35	11-27-14	Day Labor	2-1/2 ft. Concrete Shoulders		925	
	VI	Kern-Fresno-Tulare-Merced			Various Locations Apply to See Fresno Co								
	VI	Kern	4	C	S 34, T 30 S. R 28 E	Bakersfield	10.98	5-27-14	John D. Marsh	15 ft Concrete Base	141.531	6.998	148.529

CONTRACT NUMBER	DIV.	COUNTY	RTE.	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	CONSTR. ENGR.	TOTAL
[illegible](M-18)	VI	Kern	4	C	Station 4+8	Bakersfield	10.90	5-24-22	Federal Const. Co.	15 ft. Asph. Conc. Surf.	$ 108,881	$	$ [illegible]
D-51	VI	"	4	C	S. 9 & 10 T. 32 S. R. 26 E.	Bakersfield	12.98		Day Labor	Oiled Surfacing	8,325	276	8,601
D-410	VI	"	4	C	S. 9 & 10 T. 32 S. R. 26 E.	Bakersfield	3.00	11-14-21	Day Labor	Conc. Pave. 2nd Story	57,596	757	58,353
D-481	VI	"	4	C	Station 4+8	Bakersfield	10.40	3- 8-22	Day Labor	Concrete Shoulders	114,668		114,668
D-587	VI	"	4	C	Intersection County Hwy. (Sta. 1.5)+39.5			6-11-24	Day Labor	Asph. Concrete Pavement	224	2	226
50	VI	"	4	D	Bakersfield	Lerdo	10.2	2-20-14	Geo. S. Benson & Son	15' & 24' Concrete Base	76,820	4,575	81,395
D-50	VI	"	4	D	Beardsley Canal		.01	1-14-15	Day Labor	Reinforced Concrete Bridge	5,558	418	5,976
D-52	VI	"	4	D	Bakersfield	Lerdo	10.14	3-14-15	Day Labor	Oiled Surfacing	6,646	240	6,886
D-343	VI	"	4	D	Bakersfield	Beardsley Lane	.48	8-14-20	Day Labor	25 ft. 2nd Story Conc. Pave.	12,825	93	12,918
M-82	VI	"	4	D	Beardsley Canal	Lerdo	8.21	5-29-25	Federal Paving Co.	Asph. Conc. Surf. & Shldrs.	162,864	5,313	168,177
M-160	VI	"	4	D	Bridge Across Kern River			3- 9-27	Peterson & Diesler	Bridge Improvements	10,721	1,521	12,242
51	VI	"	4	E	Lerdo	Famosa	9.06	2-20-14	Geo. S. Benson & Son	15 ft. Concrete Base	63,598	4,360	67,958
D-41	VI	"	4	E	Lerdo	Famosa	9.09	4- 6-15	Day Labor	Oiled Surfacing	5,257	217	5,474
[illegible]F01	VI	"	4	E	Lerdo	Famosa	9.1	7-28-27	Farrow-Carrigan-McLeod	Asphalt Concrete Surf.	198,032	7,905	205,937
63	VI	"	4	F	Northerly Boundary	Dearborn	12.45	4-22-14	Lynn S. Atkinson	15 ft. Concrete Base	102,109	3,792	105,811
D-35	VI	"	4	F	Northerly Boundary	Dearborn	12.44	3-23-15	Day Labor	Oiled Surfacing	7,165	313	7,478
D-M-63	VI	"	4	F	Through Delano		0.29	8-18-25	Day Labor	Asphalt Concrete Surface	2,682		2,682
M-112	VI	"	4	F	1 Mi. So. Delano	1.8 Mi. So. Delano	0.75	12-14-25	Asph. Conc. Surf. & Mac. Shldrs.		13,790	325	14,115
M-123	VI	"	4	F	1 Mile So. of Delano	Northerly Boundary	2.77	5- 7-25	Warren Construction Co.	Asph. Conc. Widening & Surfacing	59,000	2,005	61,005
[illegible]F02	VI	"	4	F	1 Mile No. of Famosa	1 mile So. of Delano	9.4	7-28-27	Valley Paving & Const.Co.	Asphalt Concrete Surf.	177,195	6,685	183,880
280	(VII) (IX)	"	23	A,B	Southerly Boundary	Mojave	16.73	3-17-21	Lynn S. Atkinson	15 ft. Concrete Base	459,375	11,789	471,164
D-678	(VII) (IX)	"	23	A,B	Southerly Boundary	Mojave	16.78	11- 2-27		Balance on Cont. 280	4,573		4,573
M-108	IX	Kern-Inyo	23	D,E,G	Ricardo	Five Mile Canyon	36.70	11-30-25	Harry Wilson	Grading	19,730	118	19,848
D-553	VI	"	33	A	Westerly Boundary	Junction Pump. Sta.	15.47	10- 8-23	Day Labor	Grade & Gravel Surfacing	32,919	2,911	35,830
368	VI	"	33	B	Junction Pumping Sta.	3 Mi. E. of Hart	20.18	5-24-22	Kaiser Paving Co.	18 ft. Bituminous Macadam	547,449	19,159	566,608
397	VI	"	37	A	S.W.1/4, Sec.23, T.11 N.R.24 W.,S.B.B.& M.	Maricopa	2.71	9- 8-22	C. B. Christensen	Grading & 18' Bit. Macadam	67,239	2,372	69,611
453	VI	"	37	E	Across Cottonwood Cr.			9-22-24	J. L. Webster	Concrete Girder Bridge	34,298	1,053	35,351
D-505	VI	"	37	F				10-25-22	Day Labor	Moving House	1,350		1,350
396	VI	"	37	F	Cottonwood Creek	1st Xing Kern River	6.76	9- 8-22	W. S. Mead	Grading	435,491	23,219	458,710
D-594	VI	"	37	F	At Sta. Joaquin Light & Power Co. Bridge			8-18-24	Day Labor	Replace Suspension Bridge	420		420
D-580	VI	"	37	G	County Road	Survey Camp Buckbar		4-16-24	Day Labor	Temporary Road	1,500		1,500
D-581	VI	"	37	G	1st Xing Kern River	Tehachapi Springs	8.4	4-30-24	Prison Labor	Grading	916,323	22,843	939,166
		"			Various Locations (CM-[illegible]-21-[illegible]-130-141-146-195-[illegible]) ([illegible]FF1)-(911-FF1)-(99FF2-7)					Minor Improvements	128,838	2,330	129,168
138	VI	Kings	10	A	Hanford	Easterly Boundary	8.96	6-22-15	Geo.S. Benson & Son	15 ft. Concrete Base	95,031	3,515	98,546
D-276	VI	"	10	A	Station 90+40			10-23-19	Day Labor	Concrete Culvert	579	16	595
274	VI	"	10	B	Westerly Boundary	1 Mi. N. Lemoore	12.34	11-15-20	Bates & Borland	15 ft. Concrete Base	411,209	8,898	420,107
D-417	VI	"	10	B	Westerly Boundary	1 Mi. N. Lemoore		12- 7-21	Day Labor	Reconstructing Fence	30		30
D-483	VI	"	10	B	Westerly Boundary	1 Mi. N. Lemoore		7-26-22	Day Labor	Ext. to Kings River Bridge	7,587		7,587
361	I	Lake	15	A	Westerly Boundary	Upper Lake	9.01	5- 2-22	Redmond Page Co.	Grading	182,373	9,986	192,359
D-622	I	"	15	B	Upper Lake Branch	Stony Point	9.0	3-31-26	Day Labor	Grading	1,933		1,933
293	I	"	16	A	Westerly Boundary	Lakeport	9.36	9- 3-19	Erickson & Petterson Inc	Grading	130,774	9,849	140,623
D-364	I	"	16	A	Westerly Boundary	Lakeport	9.36	4-11-21	Day Labor	Rock Surfacing	23,884	112	23,996
		"			Various Locations (CM-[illegible]-12-17) (M[illegible]E27-9-11-12-17)					Minor Improvements			
[illegible]	III	Lassen	28	A	At Pit River			11-24-22	Day Labor	Test Pits	95		95
[illegible]	III	"	28	A	Across Pit River Main & overflow channels			9-15-24	Horn, Abt & Savage	Seven Bridges	58,749	3,890	62,639
[illegible]	III	"	28	A	9 Mile West of Bieber	Bieber	3.80	5-23-26	John F. Collins	Grading & Rock Surfacing	48,222	5,704	53,926
[illegible]	III	Lassen-Plumas	29	A	3 Mi. E. of Chester	N.E. 1/4 Sec.3 T.28 N.R.9 E.	13.67	8-15-22	Isbell Construction Co.	Grading	167,133	11,066	178,199
[illegible]	III	" "	29	A	Chester	Westwood		10-20-21	Day Labor	Test Boring	118		118

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

CONTRACT NUMBER	DIST.	COUNTY	ROUTE	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	BONUS EARNED	TOTAL COST
427	II	Lassen-Plumas	29	A	1 Mi. E. of Chester	3 Mi. East of Westwood	10.66	10- 8-24	T.H. & M.C. Polk	Rock Surfacing	$ 68,788	$ 3,937	$ 72,725
450	II	Lassen	29	A,D,E	Various Roberts Baxter & Long	Valley Junction		9-18-24	Long & Stacey	R.C. Girder Bridge	17,581	4,433	22,014
226	II	"	29	B	Susanville	Susanville	14.00	7- -22	J.P. Wolfer	Grading	101,665	33,926	134,591
231	II	"	29	B	Westside City Hdqrs.	Pine St., Susanville	.19	10-12-23	Northern Calif. Const. Co.	Grading	1,249	315	3,544
460	II	"	29	B	Susan River Near Frederick		.04	2-16-26	Rocca & Colletti	Reinforced Concrete Bridge	44,211	2,919	47,130
117	II	"	29	B	Near Susanville		1.00	1-29-17	Prison Labor	Grading	775		775
323	II	"	29	B	Coppervale	Susanville	15.00	4- 8-20	Day Labor	Rock Surfacing	130,693	126	130,819
467	II	"	29	B	In the Town of Susanville		0.19	5-25-22	Day Labor	Macadam Surface	1,453		1,453
1096	II	"	29	B	Station 504	Station 825	6.00	9- 8-22	Day Labor	Drainage Ditches	4,596		4,596
312	II	"	29	C	Across Susan River		.02	7-14-21	C.H. Gildersleeve	Concrete Bridge	9,345	594	9,939
391	II	"	29	C	Susanville	Johnstonville	4.53	9-22-21	Day Labor	Grading	46,906	1,172	48,078
497	II	"	29	C	Johnstonville	Janesville	8.04	9- 8-22	Day Labor	Rock Surfacing	5,171		5,171
380	II	"	29	C,D	Johnstonville	4 Mi.W. of Milford	17.48	7-13-22	Warren Const. Co.	Grading	128,182	4,098	128,280
599	II	"	29	C	Susanville	Johnstonville		10- 3-24	H.H. Riddell	Stockpiling Rock	1,975		1,975
48	II	"	29	C	Susanville	Johnstonville	4.54	6-11-24	T.H. & M.C. Polk	Bit. Mac. & Rock Surfacing	51,851	3,154	55,005
341	II	"	29	C,D	Janesville	4 Mi W of Milford	9.71	4-30-24	Warren Const. Co.	Rock Surfacing	50,076	2,587	52,663
603	II	"	29	D	Station 1144+00			11-14-24	Day Labor	Const. Std. Box Culvert	64		64
	II	"			Various Locations	(EM-160-161)(92EE8)				Minor Improvements	12,572		12,572
17	VII	Los Angeles	2	A	County Highway No. 1	Rancho El Encino	6.55	10-22-12	Rogers Bros. Co.	15 ft. Conc. Base & Bit. Surf.	52,177	1,494	54,671
251	VII	"	2	A	Lankershim Boulevard	So. Sherman Way	5.22	9-12-19	Bryant & Austin, Inc.	20 ft. Conc.B. & Bit. Topeka Surf	60,565	1,728	62,293
21	VII	"	2	B	Rancho El Encino	Calabasas	10.27	3- 4-13	John D. Marsh	15 ft. Conc. Base & Bit. Surf.	98,360	7,727	106,087
60	VII	"	2	B	Rancho El Encino	Shoup Avenue	5.65	8-31-21	J.G. Beekjord	Shldrs.& Conc.Pave. & Stony	140,019		142,019
398	VII	"	2	B	At Station 397+20			9-29-21	Day Labor	Install 24" C.M.P.	250		250
115	VII	"	2	B	At Chalk Hill		0.70	4- 5-26	H.A. McCray	Grading & Bituminous Mac. Pavement	503	1,833	47,336
39	VII	"	2	B,C	Shoup Avenue	Westerly Boundary	13.06	1-23-24	Geo. H. Oswald	Grad. Shldrs. 2in. Stony Conc.	451,812	16,962	452,774
33	VII	"	2	C	Calabasas	Westerly Boundary	11.28	5-21-13	Gillette,Montgomery&Tracy	15 ft. Concrete Base	127,813	8,609	146,422
257	VII	"	2	C	Russell Ranch	Former Easterly Bdry.	1.29	9-26-19	George H. Curtis	18 ft. Concrete Base	41,249	1,685	43,934
14	VII	"	2	C	Calabasas	Westerly Boundary	11.28	8-13-14	Day Labor	Oil Surfacing	19,524	638	20,162
155	VII	Los Angeles-Ventura	2	C,D	Las Virgenes, Vejor, West Fork	Vejor& Conejo Creeks		10-29-26	Henry Auerbach	Reinf. Concrete Bridges	25,604	2,870	28,474
41	VII	Los Angeles	2	D	Across the Rio Hondo		.09	5-10-21	Brolin & Son	Steel & Concrete Bridge	84,066		84,066
42	VII	"	2	D	Pasadena Avenue	Montebello	2.78	4-16-24	Geo. H. Oswald	Conc.Base & Asph.Conc. Surf.	189,222	9,195	198,417
58	VII	"	2	D	Rio Hondo Bridge			1- 3-25	Kurt O. Wetzel Co.	Walk on Bridge	3,152	570	3,722
73	VII	"	2	D	Across San Gabriel River			5- 4-25	Charles & F.W Steffgen	R.C. Girder Bridge	94,803	3,841	98,644
47	VII	"	2	D	Workmen Mills Road	San Gabriel River		8-27-23	Day Labor	Drainage Work	37,330		37,330
85	VII	"	2	D	Montebello	Whittier	3.47	6- 3-25	Kuhn Bros.	P.C. Concrete Pavement	173,805	6,576	179,381
87	VII	"	2	D	Philadelphia St.	Michigan Avenue	1.90	8-14-25	J. Paul Benson	P.C. Concrete Pavement	111,955	6,145	120,100
93	VII	"	2	D	Montebello	Michigan Avenue		5- 3-25	Day Labor	Clear R/W Obstructions	1,124	149	31,273
67	VII	"	2	D	East of Montebello			9-11-25	State's Share	Underpass L.A. & Salt Lake R.R	28,939	119	29,058
125	VII	"	2	D	Michigan Avenue	Easterly Co. Line		4- 2-26	O. R. Collins	Move Irrigation Lateral	7,251	530	7,781
116	VII	"	2	D	Across Rio Hondo	Near Los Angeles		4- 5-26	Outleben Bros.	Widen existing Bridge	91,394	3,351	94,745
139	VII	Los Angeles-Orange	2	D,F	Michigan Ave.	La Miranda St.	3.77	8-28-26	George Herz & Co.	Grading & P.C.C. Pave.	191,032	8,336	199,368
134	VII	Los Angeles	4	A	Saugus	Castaic	4.21	6- 1-15	E.R.Kennedy & F Williams	15 ft. Concrete Base	31,899	1,828	34,727
181	VII	"	4	A	Castaic	Castaic School	4.08	5-22-17	Brashear, Burns Co.	15 ft. Concrete Base	41,480	1,432	43,912
91	VII	"	4	A	Santa Clara River			12- 7-15	Day Labor	Bank Protection	3,133	242	3,375
199	VII	"	4	A	Newhall Property			8-19-18	Day Labor	Fencing Right of Way	491		491
76	VII	"	4	A	Various Places			5- 4-25	D.E. Burgess	Clean & Repaint 4 Steel Br.	6,205		6,205
329	VII	"	4	A,B	Station 320 (Sec. A)	Station 200 (Sec. B)	3.74	4- 2-20	Day Labor	Willits & Topeka Bit. Surf.	41,903	1,343	43,246
485	VII	"	4	A,B	Saugus	3/4 N.W. Castaic Sch	9.35	7-16-22	Day Labor	Asph. Concrete 2in. Stony	124,840		126,840
101	VII	"	4	B	Castaic Summit	Sec.17,T.6 N. R.17 W.	12.84	9-12-14	Mahoney Bros	Grading	134,187	12,735	146,922
202	VII	"	4	B	Castaic Summit	Kay Ranch	3.79	8-18-17	Brashear, Burns Co.	20 ft. Concrete Base	71,122	4,617	75,739

Contract No.	Dist.	County	Rte.	Sec.	From	To	Length Miles	Contract Date	Contractor	Type of Work	Contract Amt.	Current Expend.	Total
[illegible]-223)	VII	Los Angeles	[illegible]	B	Sawtelle	4.0 Mi. N.W. Santa Mon.	9.06	6-11-27	Slag Blanket	3-1/2" Slag Blanket Surface	$ 79,058	$	$ 79,058
D-63	VII	"	"	"	Culver School	[illegible]	1.64	"	Day Labor	[illegible]	99,741	1,894	61,635
305	VII	"	"	"	3/4 mi. N.W. Culver	11 Mi.S. Lisbon Mtn.	1.04	12-[illegible]-27	Subcontract Paving	[illegible] ft. Asphaltic Concrete	108,410	3,185	111,595
D-217	VII	"	"	"	Cooperative Forest Route	[illegible]	14.92	7-11-27	Day Labor	[illegible] ft. Concrete Base	358,166	5,609	363,775
D-110	VII	"	"	"	Castaic School	3 Mi.N.of Natl. Forest Inn		12-[illegible]-26	Final Maintenance	Maintaining Concrete Pavement	185,634	2,928	188,562
D-137	VII	"	"	"	Gaviota Summit	Northerly Boundary		5-[illegible]-27	Day Labor	Grade, Widening Curves	34,055	205	34,260
130	VII	"	"	"	Santa Ynez R. R.17 W.	Lizabre Mountain	14.[illegible]	1-[illegible]-24	Lee Moor Cont. Co.	Grading	316,404	13,872	330,276
D-64	VII	"	"	"	Santa Ynez R. R.17 W.	Lizabre Mountain	14.[illegible]	[illegible]-[illegible]-27	Day Labor	Widening Graded Road	(Costs D.3-[illegible] shown under D-63)		
174	VII	"	"	"	Opening Construction Ridge	Mt.		11-[illegible]-27	Day Labor	Guard Rail	1,309		1,309
W-115	VII	"	"	D	Refugio Pass Summit	1 Mi.N. of Lizabre M.Sta.	6.9	[illegible]-[illegible]-27	Day Labor	Widening, Ext. Corrugated Metal Pipe	58,144	300	58,444
[illegible]-213	VII	"	"	"	New Lizabre Maintenance Station	[illegible]		[illegible]-7-27	Day Labor	Widening Roadway	20,081	19	20,100
178	VII	"	"	"	Sta. 67+00 Sec. C	Sta. 128+70, Sec. D	6.76	1-[illegible]-28	Day Labor	[illegible] ft. Concrete Base	185,901	2,525	188,426
78	VII	"	"	"	Lizabre Mountain	Northerly Boundary	11.[illegible]	[illegible]-[illegible]-24	Lee Moor Cont. Co.	18 ft. Concrete Base	180,218	13,813	194,031
385	VII	"	"	"	Quatal Lake	Northerly Boundary	17.43	[illegible]-[illegible]-27	Southwest Paving Co.	[illegible] Asph. Surf.	290,547	9,083	299,630
D-90	VII	"	"	"	Lizabre Mountain	Northerly Boundary	6.34	12-[illegible]-26	Day Labor	Oil Surfacing	5,665	358	6,023
[illegible]-168	VII	"	"	"	Lizabre Mountain	Northerly Boundary	4.28	10-11-27	Day Labor	Oil Surfacing	3,366	212	3,578
W-34	VII	"	"	"	Quatal Lake	Northerly Boundary	10.43	12-[illegible]-27	Williams & Sandberg	Grading & Widening	42,599	4,097	46,696
406	VII	"	"	"	Across Newhall Creek	[illegible]	.02	11-[illegible]-27	W.W. Ledbetter	Reinf. Concrete Bridge	12,953	1,418	14,371
D-537	VII	"	"	"	Newhall Creek Bridge	[illegible]		5-[illegible]-27	Day Labor	Bridge Approaches	[illegible],169	102	2,271
D.W-135	VII	"	"	"	Sta. 132+85.[illegible]	Sta. 152+45.40		4-28-[illegible]	Day Labor	Guard Rail	4,974	111	5,085
W-150	VII	"	"	E	Across La Placerita Creek, near Newhall	[illegible]		10-12-[illegible]	I.P. Lipo	Two Reinf. Conc. Bridges	18,281	1,417	19,698
107	VII	"	"	A	Rio Tujunga	L. Canada	4.90	7-2-[illegible]	A. Holloway	[illegible] ft. Concrete Base	51,949	4,755	56,704
213	VII	"	"	A	San Fernando	Rio Tujunga	13.02	11-[illegible]-27	A.L.McCray & C.H.Oswald	18 ft. Concrete Base	138,648	7,981	146,629
284	VII	"	"	A	Across N.Fk. Tujunga River	[illegible]	.16	5-[illegible]-21	W.W. Ledbetter	Reinforced Concrete Bridge	129,612	4,367	134,279
295	VII	"	"	A	Across S.Fk. Tujunga River	[illegible]	.03	5-[illegible]-21	Morgereau Br. & Const. Co.	Concrete Bridge	30,310	1,080	31,390
[illegible]-234	VII	"	"	A	At Dangerous Points	[illegible]	.30	5-[illegible]-[illegible]	Day Labor	Guard Rail	718		718
[illegible]-356	VII	"	"	A	At [illegible]ensa[illegible] Br	[illegible]	.02	[illegible]-[illegible]-21	Day Labor	Paving Bridge Approaches	793		793
[illegible]-470	VII	"	"	A	At Tujunga Wash	[illegible]		[illegible]-[illegible]-[illegible]	Day Labor	Slope Protection	7,742	166	7,908
[illegible]-508	VII	"	"	A	Maclay Ave. & Maint. St. near	San Fernando	.09	[illegible]-[illegible]-[illegible]	Day Labor	15 ft. Concrete Base	2,337		2,337
[illegible]-571	VII	"	"	A	Pacoima Bridge	[illegible]	.21	2-[illegible]-[illegible]	Day Labor	20 ft. Concrete Pave.	12,661	61	12,722
[illegible]-243	VII	"	"	A	At The Big Tujunga Wash	[illegible]	.[illegible]	[illegible]-[illegible]-27	Day Labor	Grading and Bit.Mac.Pave.	[illegible],232	690	9,922
[illegible]-131	VII	"	"	A	Sta. Fernando	La Canada	15.[illegible]	[illegible]-[illegible]-[illegible]	Dewey & Rawson	Portland Cement Conc.Pave.Wide.	193,[illegible]	11,933	205,[illegible]
D-34	VII	"	"	A.C	County Highway Div.#4	Easterly Boundary	.68	[illegible]-[illegible]-15	Day Labor	18 ft. Con. Base-Bit Surf.	10,[illegible]	850	10,[illegible]
[illegible]-385	VII	"	"	[illegible]	Station 58+[illegible]	Station 60+12		[illegible]-[illegible]-21	Day Labor	Improving Intersection			
W-157	VII	"	"	[illegible]	Across Eaton Canyon Wash	[illegible]		10-[illegible]-[illegible]	Sidney Smith	Reinf. Concrete Bridge	34,774	1,277	36,051
391	VII	"	"	C	San Gabriel River	[illegible]	.19	[illegible]-[illegible]-[illegible]	D.A. Foley & Co.	Reinf. Concrete Bridge	151,[illegible]	4,194	156,[illegible]
421	VII	"	"	C	Fish Canyon	Azusa	.07	6-[illegible]-[illegible]	W.D. McCrary	Grav. & Bit. Conc. Pave.	34,584	1,746	43,[illegible]
[illegible]-567	VII	"	"	C	San Gabriel River Bridge	[illegible]	.19	11-[illegible]-[illegible]	Day Labor	Azusa Surf. on Bridge	2,[illegible]		2,[illegible]
[illegible]-190	VII	"	"	C	Near Glendora	[illegible]		[illegible]-10-[illegible]	Day Labor	Brick Protection	400		[illegible]
0793	VII	"	"	C	San Dimas Line Orange	[illegible]		8-17-27	Day Labor	Removing Orange Trees	178		178
428	VII	[illegible]	[illegible]	[illegible]	Santa Clara River	1/3 Mi. East	.19	10-[illegible]-[illegible]	H. E. Cox	20 ft. Concrete Pavement	13,067	750	13,817
[illegible]-167	VII	[illegible]	[illegible]	[illegible]	Santa Clara River Bridge	[illegible]		[illegible]-[illegible]-[illegible]	Day Labor	Concrete Piling	1,621		1,[illegible]
[illegible]-306	VII	[illegible]	[illegible]	[illegible]	Santa Clara [illegible] Br. Approx.	[illegible]		[illegible]-[illegible]-[illegible]	Day Labor	Grading	104		104
237	VII	[illegible]	[illegible]	[illegible]	Santa Clara River Br.	[illegible]	.04	1-[illegible]-[illegible]	J.P.Hunter & R.A. Mattson	Concrete Bridge	11,667	808	12,[illegible]
250	VII	[illegible]	[illegible]	[illegible]	Santa Clara River	Williams Ranch	1.86	[illegible]-[illegible]-[illegible]	Premoldcast Const.Co	20 ft. Concrete Base	43,[illegible]	1,456	51,[illegible]
[illegible]-150	VII	[illegible]	[illegible]	[illegible]	Saugus Ranger	Newhall	12.60	[illegible]-[illegible]-[illegible]	Day Labor	20 ft. Concrete Base	20,[illegible]	5,514	212,[illegible]
258	VII	[illegible]	[illegible]	[illegible]	2 Mi. W. of Acton	Fairmont	8.64	[illegible]-[illegible]-[illegible]	Fred Hoffman	20 ft. Concrete Base	28,[illegible]	12,267	285,[illegible]
[illegible]-179	VII	[illegible]	[illegible]	[illegible]	Near Acton	Near Fairmont	2.00	1-[illegible]-[illegible]	Day Labor	Grading	14,[illegible]	662	19,[illegible]
[illegible]-38	VII	[illegible]	[illegible]	[illegible]	In Palmdale	[illegible]		7-17-[illegible]	Day Labor	Betterment			2,[illegible]

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

CONTRACT NUMBER	DIV	COUNTY	RTE	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	ENGR. COST	TOTAL COST
M-253	VII	Los Angeles	91	F	At Lancaster		1.0	4-13-27	Southwest Paving Co.	Asphalt Concrete Surface	10,185	[illegible]	$ 10,400
247	VII	" "	91	G	Lancaster	Northerly Boundary	6.13	5-10-21	Southwest Paving Co.	15 ft. Concrete Base	283,332	11,0[illegible]	294,337
D-521	VII	" "	90	A	Latigo Creek	Corral Creek	1.10	12-19-22	Day Labor	Grading	75,746	[illegible]	78,969
514	VII	L.A.-Ventura	91	A	(See Cont. 214-Ven-LA-60-A)								
453	VII	Los Angeles	90	A	Arroyo Seguit	Las Flores Canyon	16.13	2-13-25	S. Wright Jewett	Grading	303,943	28,[illegible]	332,371
487	VII	" "	90	A	Latigo Creek	Las Flores Canyon	6.70	11-13-25	Ed. Johnson & Sons	Portland Cement Concrete Pave	247,578	[illegible]	266,134
D-625	VII	" "	90	A	At Carbon Point & near Malibu Wharf			4-22-26	Day Labor	Construct Bulkhead	12,879		13,174
D-639	VII	" "	90	A	At Arroyo Seguit Bridge			3-27-28	Day Labor	Expense Due to Delay	874		874
D-664	VII	" "	90	A	At Topanga, Dume & Escondido Cr. & Arroyo Seguit			4-11-28	Day Labor	Inspection of 4 Co. Bridges	1,109		1,109
D-667	VII	" "	90	A	At Las Flores, Malibu, Corral & Solstice Cr.			6-20-27	Day Labor	Inspection of 4 Co. Bridges	2,168		2,168
D-672	VII	" "	90	A-B	Castle Rock	Malibu Creek		9- 2-27	Day Labor	Pipe Purchase	4,763		4,763
97803	VII	" "	91	A-B	Nicolas Canyon	Los Angeles	21.4	1- 5-28	Santa Fe Pipe-Sup Co.	Pipe Line Const.	32,075	[illegible],708	53,783
D-607	VII	" "	91	B	Santa Ynez River			2- 2-25	Day Labor	Bridge-Grade & Pave Approach	2,595	131	2,726
338	VII	" "	90	B	Las Flores Canyon	Santa Monica	7.39	11- 8-21	Lee Moor Cont. Co.	20 ft. Concrete Pavement	295,728	[illegible],889	328,617
D-628	VII	" "	90	B	Las Flores Canyon	Santa Monica		2- 3-22	Day Labor	Removing Slides from R/W	19,726	[illegible]	20,927
D-668	VII	" "	90	B	Las Flores Canyon	Santa Monica		9-20-22	Day Labor	Groynes for Shore Protection	3,057	[illegible]	3,724
D-594	VII	" "	90	B	Topanga Creek Bridge			10- 8-23	Day Labor	Grad. & Pave. Appr	1,171		1,171
D-620	VII	" "	90	B	Santa Monica	Northerly Boundary		3-16-26	Day Labor	Rip Rap Slopes	18,808		18,808
D-609	VII	" "	91	E	Sta. [illegible]	75+50		2-25-25	Day Labor	Remove Bridge-P.C.C. Pave.	3,127	10	3,137
403	VII	L.A.-Orange	90	E-A	Long Beach	Huntington Beach	7.77	10- 4-22	A.H. Peterson	Grad. & 20' Conc. Pave	317,161	[illegible],146	335,307
D-568	VII	" "	90	E-A	Sta. 20+50 "E"	Sta. 1+86 "A"		1-23-24	Day Labor	Timber Bulkhead	1,839		1,839
525	VII	Los Angeles	90	E-A	Naples	Anaheim Bay Br.	1.5	6- 1-27	Matich Bros.	P.C.C. Pave	52,942	[illegible],513	55,455
97802	VII	" "	91	A	Near Burnside			9- 2-27	J.W. Breedlove Inc.	Grading	11,465	[illegible],203	12,668
M-114	VII	" "			At Lancaster			3-17-26	Hodge & McMackin	Maintenance Shop Building	18,054		18,054
	VII	" "			Various Locations					Minor Improvements	88,791	1,306	90,097
9	VI	Madera	4	A	Southerly Boundary	(D M-53-78-80-182-192-267-271) (97772-3-9) Madera	9.99	8-27-12	Borswick St.Pav.Co.	15 ft. Conc. Base-Oil Surf.	73,666	[illegible],234	77,900
386	VI	"	4	A	Southerly Boundary	Madera	.83	6- 9-22	Federal Constr.Co.	15 ft. Asph. Conc. Surf	13,155	764	13,919
D-457	VI	"	4	A	Arcola School	Borden Station	1.00	5- 8-22	Day Labor	Concrete Shoulders	7,868	404	8,272
M-120	VI	"	4	A	Borden	Madera	2.09	4-23-26	Hanrahan Co.	Portland cement conc. widening	18,246	[illegible],158	20,404
3	VI	"	4	B	Madera	Calif.	17.00	7-23-12	Kanouse Gruzsey Co.	15 ft. Oil Macadam	68,927	[illegible],905	73,832
10	VI	"	4	C	Calif.	Northerly Boundary	6.98	8-27-12	Borswick St. Pav.Co.	15 ft. Conc. Base-Oil Surf.	49,856	[illegible],663	54,489
482	VI	"	4	C	Across Chowchilla Riv.			12-13-24	Proctor & Cleghorn	Reinforced Concrete Bridge	13,136	1,726	14,862
D-591	VI	"	4	A	Ash Slough	Westerly End	5.5	6-18-24	Day Labor	Repair Co Road, used as detour	5,275	6	5,281
413	VI	Madera-Merced	4	A,2	Westerly Boundary	Calif.	14.68	12-19-22	R.T. Shea	Grade. & 16' Bit. Mac.	380,262	9,109	389,371
150	IV	Marin	1	A	Northerly Boundary	Gallinas Creek	4.00	8-10-15	R.B. Markle, Jr.	Grading	29,653	[illegible],805	29,658
208	IV	"	1	A	Northerly Boundary	San Rafael	15.97	10-17-17	Edmund J. Treacy	15 ft. Concrete Base	343,054	24,570	367,424
D-485	IV	"	1	A	Northerly Boundary	Gallinas Creek	1.04	12- 2-15	Day Labor	Rock Surfacing	3,463	43	3,506
D-226	IV	"	1	A	Station "A"	Station 248+40	.03	3-31-19	Day Labor	Removing Slides	5,695	197	5,892
D-340	IV	"	1	A	At Northerly City Limits San Rafael			8-25-21	Day Labor	Reconst. Conc. Base	568	69	627
65	IV	"	1	B	Larkspur	Sausalito	4.00	5-27-14	O'Brien Bros.	Grading	70,571	[illegible],147	75,718
175	IV	"	1	B	Larkspur	Sausalito	.06	7-10-16	Marin Rock Co.	18 ft. Concrete Base	59,695	[illegible],108	69,804
D- 36	IV	"	1	B	Ross	Larkspur	.89	4- 6-15	Day Labor	18 ft. Concrete Base	17,654	588	18,242
D- 37	IV	"	1	B	At Corte Madera Cr.		.06	4- 6-15	Day Labor	Grading	1,064	305	1,369
D-233	IV	"	1	B	Larkspur	Sausalito	.98	5- 8-19	Day Labor	18 ft. Concrete Base	24,771	[illegible],971	[illegible]
D-399	IV	"	1	B	Thru San Anselmo		.56	8-22-21	Day Labor	Conc.Shldrs. & Asph.Conc Surf	19,533	865	[illegible]
M-105	IV	"	1	B	In Sausalito	Sta.620+06 ' to 640+29.)		5-14-26	Day Labor	Asphalt Concrete Surfacing	10,025	551	[illegible]
M-136	IV	"	1	B	Across Corte Madera Cr.			8-16-26	McDonald & Maggiora	Widening Bridge	11,412	[illegible],570	[illegible]
M-141	IV	"	1	B	Ross	Sausalito	1.4	9-14-26	Pac.States Const.Co.	Asphalt Concrete Surf	19,812	[illegible],345	[illegible]
94[illegible]21	IV	"	1	B	Ross	Larkspur	.71	1- 4-28	Pac.States Const.Co.	Asphalt Concrete Surf	18,124	660	[illegible]
214	IV	"	1	A	Novato Cr. & Simon Street		1.9	12-19-17	Duncanson-Harrison Co.	Concrete Structures	40,821	705	[illegible]
254	IV	"	1	A	Novato	Black Point	.75	8-26-18	H.C. Flinn	Grading	10,926	[illegible],458	[illegible]

CONTRACT NUMBER	DIV.	COUNTY	RTE.	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTING COST	MAINT. EXPEN.	TOTAL
S-110	IV	Marin	2	A	Station 0+00	Station 14+00	0.42	8-14-16	Day Labor	Grading	$ 14,755	$ 1,336	$ 16,091
S-823	IV	"	2	A	N.W.P.R.R. Crossing			10-27-26	Day Labor	Automatic Flagman	879		879
163	IV	Marin-Sonoma	2	A	Petaluma Creek Bridge		.27	1-11-16	Hemly-Tibbitts Con.Co.	Bascule Bridge	101,577	6,966	108,543
317	IV	" "	2	A	Ignacio	Petaluma	9.77	8-31-21	Sweet South Co.	Grad. & 12' Asph.Conc.Pave.	204,136	16,886	221,022
S-282	IV	" "	2	A	Petaluma Creek Bridge			11-16-16	Day Labor	Auxiliary Power	961		961
M- 46	IV	" "	2	A	Across Petaluma Cr.			5-21-24	Jenkins & Elton	Painting Bridge			4,768
M-153	IV	" "	2	A	Petaluma Creek Bridge			10-22-26	Healy-Tibbitts Const. Co.	4 Pile Dolphins	10,281		10,281
375	IV	Marin	2	A	Alto	Belvedere Crossing	3.49	6-28-22	J.A.Modin & W.C. Preston	Grading	40,693	2,536	58,229
S-575	IV	"	2	A	Alto	Belvedere Crossing	3.49	3- 5-24	Day Labor	Rock Surfacing	1,932	23	1,955
	IV	"			Various Locations (D.M-211-923)					Minor Improvements	7,153		7,153
157	VI	Mariposa	18	A	Easterly Boundary	Cathay-White Rock Rd.	10.05	11- 9-15	G.R. Daley	Grading	71,870	6,555	78,425
S-111	VI	"	18	A	Owens Cr. Bridge, Sta. 409		.02	10-11-16	Day Labor	Concrete Bridge	5,400	443	5,843
S-143	VI	"	18	A	Easterly Boundary	Cathay-White Rock Rd.	10.06	7- 3-17	Day Labor	Oil Surface on Portions	1,875	28	1,903
S-108	VI	"	18	B	Cathay-White Rock Rd.	Agua Fria Creek	7.83	7-28-16	Day Labor	Grading	141,806	5,065	146,871
S-M-235	VI	"	18	B,C	Cathay	Mariposa	14.2	2-23-27	Day Labor	Grading & Rock Surfacing	17,993	482	18,475
S-170	VI	"	18	C	Agua Fria Creek	Mariposa	6.70	10-17-17	Day Labor	Grading	89,852	1,898	91,750
S-244	VI	"	18	C	Agua Fria Creek Bridge		.03	8- 5-19	Day Labor	Concrete Bridge	9,291	75	9,366
S-M-184	VI	"	18	C,D	Sta. 408 Sec. C	Sta. 409 Sec. D	0.05	9-20-26	Day Labor	Rock Surfacing	26,622	879	27,501
S-249	VI	"	18	D,E	Bridgeburg	Cathay	15.3	2-23-27	Day Labor	Rock Surfacing	22,000	395	22,395
301	VI	"	18	E	Mariposa	Sierra Nat'l Forest	7.84	5-25-21	Palmer & McBryde	Grading	157,642	11,992	169,634
353	VI	"	18	E	Sierra National Forest	Bridgeburg	5.69	2- 7-22	F. Rolandi	Grading	234,005	17,046	251,051
444	VI	"	18	E	Across Bear Creek at Bridgeburg			3-17-26	Smith Bros.	Concrete Girder Bridge	26,452	1,323	27,775
M- 145	VI	"	18	E	Across Bear Cr. 3 Mi. So. of Bridgeburg			9-14-26	Noble Bros.	Reinf. Concrete Bridge	13,911	1,653	15,564
M-E201	VI	"	18	E	King Solomon Mine	Bridgeburg	1.25	11- 1-27	B.C. Burnett	Guard Rail	6,927	191	7,118
495	VI	"	18	E,F	Across Slate Gulch & Sweetwater Creek			3-17-26	Noble Bros.	2 - Concrete Arch Bridges	20,295	1,281	21,576
S-550	VI	"	18	E,F,G	Bridgeburg	El Portal	16.96	9-20-26	Prison Labor	Grading	1,279,860	41,226	1,331,086
3671	VI	Mariposa	18	E,F,G	El Portal			8- 9-27	Camp 8	Payment of Convict Wages	2,499		2,499
S-619	VI	"	18	F	Across So. Fork of Merced Riv.			4- 1-26	Prison Labor	Reinforced Concrete Bridge	32,004	2,442	34,446
486	VI	"	18	G	Across Merced River			10-23-25	Otto Parlier	Reinforced Concrete Bridge	32,215	2,001	34,216
S-244	VI	"	18	H	El Portal	Yosemite Nat'l Park	1.23	1- 6-20	Day Labor	Grading	38,846	436	39,282
S-481	VI	"	18	H	S.F.Sta. at El Portal	Yosemite Park Dairy	1.24	7-26-22	Day Labor	20' Conc. Pave. & Retain. Wall	66,594	885	67,479
		"			Various Locations (D.M-178-210-294) (D.M-E211) (D.M-E228)					Minor Improvements	26,857	188	27,045
2	I	Mendocino	1	A	Southerly Boundary	Hopland	12.91	7-23-12	General Cont. Corp.	Grading	93,019	2,675	95,694
87	I	"	1	B	Hopland	Ukiah	11.41	8-11-14	Hard Bros.	Grad. & 15' Conc. Base	94,223	8,164	102,387
387	I	"	1	B	Ukiah	El Sasbes	9.89	8- 9-22	Murdock Bros.	Grad. & Rock Surfacing	89,929	7,147	97,128
S-113	I	"	1	B	1 Mi. So. of Ukiah	Ukiah	1.36	8- 8-16	Day Labor	Oil Surfacing	3,699	30	3,729
24	I	"	1	C	Ukiah	Forsythe Creek	7.73	3-26-13	D.L.Sawyer & C.Whited	Oiled Macadam	78,748	5,419	84,167
57	I	"	1	D	Forsythe Creek	Ridgewood	6.56	4-22-14	Hard Bros.	Grading	59,904	5,027	64,931
S- 4	I	"	1	D	Station [illegible]	Station 420	1.34		Day Labor	Grading	16,646	1,029	17,675
S-302	I	"	1	D	Forsythe Creek	Ridgewood	7.77	2- 6-20	Day Labor	Widening	63,214	3,356	66,570
S-492	I	"	1	D	Station 25	Station 389	2.0	8-31-22	Day Labor	Rock Surfacing	3,180		3,180
S-590	I	"	1	D,E	Station 393+00 D	Station 392+[illegible] E	.67	6-19-24	Day Labor	Seal Coat on Bit. Mac.	10,514		10,514
354	I	"	1	D,E,F	Forsythe Creek	Outlet Creek	17.72	2-24-22	Conners & Hansen	Grade, Gravel & Bit. Mac.	281,932	19,247	301,179
20	I	"	1	E	Ridgewood	Willits	6.34	3- 4-13	Fairbanks & Buechtel	Grading	39,138	3,415	42,553
S-303	I	"	1	E	Ridgewood	Willits		2- 6-20	Day Labor	Widening	34,547	1,793	36,340
S-493	I	"	1	E	Station 500	Station 635		8-31-22	Day Labor	Rock Surfacing	3,000		3,000
S-562	I	"	1	E	Mill Creek Bridge			11-26-23	Day Labor	Constr. Approaches	1,030		1,030
215	I	"	1	F	Willits	Arnold	8.24	12-19-17	Erickson & Petterson	Grading	128,878	5,504	134,382
232	I	"	1	F	Outlet Creek			7-19-18	C.H. Gildersleeve	Reinforced Concrete Bridge	14,525	203	14,728
334	I	"	1	G	Across Outlet Creek		.03	6-15-21	Ward B. Esterly	Concrete Bridge	16,877	891	17,768
307	I	"	1	G	Across Long Valley Cr.		.06	6-15-21	Rocca & Calcetti	2 Concrete Bridges	17,710	867	18,577
306	I	"	1	G	Across Long Valley Cr.		.01	6-22-21	C.H. Gildersleeve	2 Concrete Bridges	7,817	241	8,058

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

Number	Dist	County	Route	Type	From	To	Length Miles	Contract Date	Contractor	Type of Work	Construction Cost	Right of Way Cost	Total
[illegible]	I	Mendocino	1	G	Under M.P. [illegible] near Arnold			4-21-21	Hamm & Belletti	Undercrossing	$ [illegible]	$ 3,478	$ [illegible]
[illegible]	I	"	1	G	Arnold	Sherwood	10.19	4-25-17	Prison Labor	Grading	[illegible]	7,213	[illegible]
S-[illegible]	(I	Mendocino	1	GH(A)	Sec D-3[illegible] I-Men-1-ARC[illegible] and I-Men-1 [illegible]LY								
D-[illegible]	I	Humboldt	1	AB(P)									
	I	Mendocino	1	D	Arnold Undercrossing			8- 9-22	Day Labor	Paving Undercrossing	3,747	79	3,826
[illegible]	I	"	1	H	Sherwood Junction	Rattlesnake Summit	13.76	6- 7-18	Prison Labor	Grading	[illegible]	7,648	[illegible]
[illegible]	I	"	1	I,J,K	Rattlesnake Summit	Northerly Boundary	33.63	4- 1-15	Prison Labor	Grading	[illegible]	[illegible]	[illegible]
[illegible]	I	"	1	I,J,K	Rattlesnake Summit	Northerly Boundary		4-21-15	Day Labor	Grad. Widen. & Rock Surf	[illegible]	[illegible]	[illegible]
M-[illegible]	I	"	1	J	Leggett Valley	2 Mi. N of Rock Creek	6.30	5- 4-28	Butterfield Sears Co.	Grading & Rock Surfacing	[illegible]	11,108	[illegible]
[illegible]	I	"	15	A	2-1/2 Mi N Ukiah	Easterly Boundary	13.06	5-10-21	E.Zimmerli & C.J. Hilland	Grading	157,[illegible]	14,489	171,[illegible]
[illegible]	I	"	15	A	East Br of Russian River			7- 8-20	W L Proctor	Reinforced Concrete Bridge	14,[illegible]	221	14,[illegible]
[illegible]	I	"	15	A	Cold Creek at Sta [illegible]		.02	7-30-20	C.H.Gildersleeve	Reinforced Concrete Bridge	[illegible]	108	[illegible]
[illegible]	I	"	15	A	Cold Creek at Sta [illegible]		.01	7-30-20	C.H.Gildersleeve	Reinforced Concrete Bridge	[illegible]	198	[illegible]
[illegible]	I	"	15	A	Sta. 0+00	Station [illegible]+30	6.50	9-25-21	Day Labor	Rock Surfacing	38,[illegible]	605	38,[illegible]
[illegible]	I	"	15	A	Bridges E Russian R & Cold Cr Sta [illegible] & 37[illegible]			12-14-22	Day Labor	Grad. & Rock Surf. Appre	[illegible],000	270	[illegible]
[illegible]	I	"	16	A	Hopland	Easterly Boundary	9.74	6-26-19	J P Holland	Grading	166,[illegible]	13,308	180,[illegible]
[illegible]	I	"	42	C	Flynn Creek	Mo of Navarro R	11.68	11-30-21	J P. Holland	Grading	209,[illegible]	3,380	212,[illegible]
M-[illegible]	I	"	42	C	Flynn Creek	Mo of Navarro R	11.98	8-16-22	Day Labor	Rock Surfacing	64,[illegible]	405	6[illegible]
[illegible]	I	(Mendocino (Humboldt			See M-29 Humboldt- Mendocino								
	I	Mendocino			Various Locations [illegible]					Minor Improvements	26,720	377	[illegible]
[illegible]	VI	Merced	4	A	Merced	Southerly Boundary	14.27	5-27-14	Taylor & Berliner	15 ft. Concrete Base	121,[illegible]	6,915	[illegible]
[illegible]	VI	"	4	A	Merced	Southerly Boundary	14.35	4- 6-15	Day Labor	Oil Surfacing	3,[illegible]	393	[illegible]
[illegible]	VI	"	4	A	Station [illegible]+[illegible]		.06	10-31-15	Day Labor	15 ft Concrete Base	[illegible]		[illegible]
[illegible]	VI	"	4	A	Station [illegible]+47	Station [illegible]+47	.01	1-29-18	Day Labor	15 ft Concrete Base	[illegible]		[illegible]
[illegible]	VI	"	4	A	Station 312+[illegible]	Station [illegible]+00		3-14-19	Day Labor	15 ft. Concrete Base	[illegible]		[illegible]
M-[illegible]	VI	"	4	A	Merced	Southerly Boundary	14.33	2-[illegible]-[illegible]	Allied Contractors Inc.	P.C.C. Widening & A.C. Surf	162,[illegible]	3,[illegible]	[illegible]
M-[illegible]	VI	"	4	A	Athlone	Southerly Boundary	4.51	3- 4-27	Allied Contractors Inc	P.C.C. Widening & A.C. Surf.	[illegible],[illegible]	3,196	[illegible]
[illegible]	VI	"	4	A,C	Canal Cr-3/4 Mi [illegible] W Merced Franklin Sch -Owens C		6.31	11- 7-13	Valley Pav & Const Co	15 ft. Asphalt Conc. Surface	[illegible],[illegible]		[illegible]
[illegible]	VI	"	4	A,C	Southerly Boundary	Arena	2.86	11- 3-21	Day Labor	Concrete Shoulders	2,[illegible]	340	[illegible]
[illegible]	VI	"	4	A,C	(Sec.A.Sta.174+[illegible] to Sta.275+67) (Sec C Sta [illegible]+[illegible] to Sta.1030+60)		4.52	3- 8-27	Day Labor	Conc. Pave. 2nd Story	61,742		61,[illegible]
[illegible]	VI	"	4	C	Arena	Merced	10.86	3-25-12	Morewick St.Pav.Co	15 ft. Conc-Base-Oil Surf	[illegible],217	6,[illegible]	102,[illegible]
[illegible]	VI	"	4	C	Station [illegible]+33		.01	12-[illegible]-17	Day Labor	15 ft. Concrete Base	1,[illegible]	[illegible]	[illegible]
M-[illegible]	VI	"	4	C,D	Merced River	Buhach	6.41	5-13-26	H. H. Peterson	P.C.C.Pave. & Widening	167,171	5,790	172,[illegible]
[illegible]	VI	"	4	C	Atwater			11- 6-19	Day Labor	7-1/2 ft Concrete Shoulders	1,[illegible]		1,[illegible]
[illegible]	VI	"	4	C,D	Through Atwater & Livingston		1.00	5- 8-22	Day Labor	Concrete Shoulders	21,[illegible]	[illegible]	[illegible]
[illegible]	VI	"	4	D	Northerly	Arena	9.74	4-27-12	Morewick St. Pav.Co	15 ft. Conc.Base-Oil Surf.	[illegible],[illegible]	4,[illegible]	[illegible]
[illegible]	VI	"	4	D	Delhi	Northerly Boundary	4.26	4-[illegible]-[illegible]	J. A Costello Jr	Asphaltic Conc. Surf.	92,[illegible]		92,[illegible]
[illegible]	VI	"	4	D	Sta.6+56 & Sta 7+[illegible]		.02	7- 5-17	Day Labor	15 ft. Concrete Base	688		688
[illegible]	VI	"	4	D	Sta 7+15 Sta [illegible]+[illegible] & Sta 2[illegible]+[illegible]		.02	3-14-18	Day Labor	Bridges	3,[illegible]	45	3,[illegible]
[illegible]	VI	"	4	D	Sta. 375+00 & Sta [illegible]+00			8- 5-19	Day Labor	Culverts	1,[illegible]		1,[illegible]
[illegible]	VI	"	4	D	At Livingston		.15	4-[illegible]-20	Day Labor	Concrete Shoulders	1,117		1,117
[illegible]	VI	Merced-Madera-Tulare-Fresno			Various Locations Route 4	See Fresno 26							
[illegible]	VI	Merced	18	A	Merced	Easterly Boundary	14.89	6-26-19	J E Lee	15 ft. Concrete Base	334,262	15,738	350,000
[illegible]	VI	"	18	A	(Planada (La Grande Interment	2 Miles East) 1/2 Mile East)	2.7	6-14-26	Day Labor	Bituminous Macadam Surface	10,784		10,784
[illegible]	VI	"	32	A	Westerly Boundary	San Luis Creek	8.49	6-15-20	Pacific Const Co	Grad & 16' Conc. Pave	172,322	8,677	181,[illegible]
[illegible]	VI	"	32	A	Station 0+00	Station [illegible]+30	2.50	11- [illegible]	Day Labor	Rock Surfacing	2,[illegible]	[illegible]	2,[illegible]
[illegible]	VI	"	32	B	San Luis Creek	Los Banos	16.26	6-15-27	Blanco & Taylor	16 ft Conc. Pavement	391,748	12,789	404,537

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

CONTRACT NUMBER	DIV	COUNTY	RTE	SEC	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	CONST. ENGR.	TOTAL
D-572	VI	Merced	32	B	Station 601	Station 603		2-26-24	Day Labor	Pav. Bridge Appr	$ 1,021	$ 204	$ 1,225
308	VI	"	32	C	Los Banos	Easterly Boundary	20.64	1-30-21	Bates & Rogers Const Co.	15 ft. Concrete Base	635,140	19,836	654,976
D-460	VI	"	32	C	San Joaquin Overflow Area			5-5-22	Day Labor	Willow Mat	333		333
W-88	VI	"	32	C	Los Banos	San Joaquin River	10.00	6-17-25	Kaiser Paving Co	Rock Borders	24,895	760	25,655
413	VI	Merced-Madera	32	C,A	See Cont 413 VI-Mad-Mer-32-A,C								
0822	VI	Merced	32	C	Los Banos	6 Miles East	6.0	12-6-27	Larsen Bros	Widening Roadbed	3,356	222	4,178
1201	VI	"	32	C	Los Banos	Easterly Boundary	8.7	11-16-27	Larsen Bros	Rock Borders	18,430	841	19,271
	VI	"			Various Locations	(DM-108) (99EE-3-3-5)				Minor Improvements	16,583	307	16,890
D-236	II	Modoc	28	A	Adin Summit	Canby	10.85	5-28-19	Day Labor	Grading & Rock Surfacing	268,414	4,398	272,812
D-392	II	"	28	A	Across Pit River			4-22-21	Day Labor	Concrete Bridge	42,810	44	42,854
D-341	II	"	28	B	Canby	Hot Creek	9.70	5-24-20	Day Labor	Grading & Rock Surfacing	160,272	506	160,778
527	II	"	28	B	Across Rattlesnake Cr			7-7-27	Fred J Maurer &Son, Inc	Reinf. Concrete Bridge	9,022	1,818	10,840
D-377	II	"	28	C	On West Side of Cedarville	Mountain	7.70	8-11-21	Day Labor	Rock Surfacing	65,312	4,751	70,063
W-151	II	"	28	C	Alturas	Hoyce Ranch	10.84	6-8-26	J P Holland Inc.	Rock Surfacing	60,407	3,226	63,633
	II	"			Various Locations	(99EE7)				Minor Improvements	1,448		1,448
D- 79	IX	Mono	23	A	Southerly Boundary	Sherwin Hill	5.80	10-4-15	Day Labor	Grading	45,140	3,319	48,459
D-101	IX	"	23	B	Sherwin Hill	Whiskey Canyon	8.0	4-4-16	Day Labor	Grading	18,664	346	19,010
D-126	IX	"	23	B	Rock Creek Bridges			5-15-17	Day Labor	Concrete Bridges	8,342	189	8,531
D-191	IX	"	23	B	Rock Creek Canyon		3.28	4-30-18	Day Labor	Widening Curves, Etc	38,633	3,306	42,139
D-129	IX	"	23	C	Hilton & McGee Creeks			5-15-17	Day Labor	Bridges	7,158	304	7,462
D-218	IX	"	23	C	Whiskey Canyon	McGee Creek	7.61	3-6-19	Day Labor	Grading	100,743	5,182	105,931
D-150	IX	"	23	C	Convict & Hot Creeks			5-15-17	Day Labor	Bridges	11,039	748	11,787
D-107	IX	"	23	D	Station 0+00	Station 10+00	1.9	7-13-18	Day Labor	Grading	1,734	274	2,008
D-103	IX	"	23	F	Dead Man Creek	Devils Punch Bowl	5.80	4-24-16	Day Labor	Grading	27,843	1,159	29,002
D-124	IX	"	23	G	Devils Punch Bowl	Tioga Road	11.70	6-19-18	Day Labor	Grading	73,337	4,195	77,532
300	IX	"	23	H,I	Tioga Pass Road	Dogtown	19.10	5-25-21	Nevada Contracting Co	Grading	234,742	26,603	261,345
D-487	IX	"	23	I	McKay Ranch Road			8-9-22	Day Labor	Maintaining Detour	129	18	147
	IX	"			Various Locations	(DM-60-175) (99FF1-5-6)				Minor Improvements	70,734	282	71,042
41	V	Monterey	2	A	Lagunita	Easterly Boundary	4.34	10-29-13	E.O Burge	Grading	15,621	3,659	19,276
151	V	"	2	A	Salinas	Lagunita	4.93	4-30-15	Burns, Jacinto & DaRosa	15 ft. Concrete Base	47,270	1,870	49,140
D- 61	V	"	2	A	Lagunita	Easterly Boundary	4.34	9-19-13	Day Labor	15 ft. Concrete Base	51,192	3,008	54,200
162	V	"	2	A	Station 210	Station 374	3.10	9-26-17	Day Labor	Oil Surfacing	9,629	51	9,680
202	V	"	2	A	Salinas	Santa Rita Road	1.9	10-11-27	Chas. W Wimmer	Grading & P.C.C. Pavement	59,963	3,082	63,045
137	V	"	2	B	Chualar	Salinas	10.29	6-2-15	W.A. Dontanville	15 ft. Concrete Base	82,262	2,964	85,226
D-163	V	"	2	B	Station 0+00	Station 545	10.28	9-26-17	Day Labor	Oil Surfacing	9,224	111	9,335
184	V	"	2	C	Chaphora	Chualar	10.95	7-2-17	Palmer & McBryde	15 ft. Concrete Base	113,501	4,570	118,071
152	V	"	2	C	Greenfield	Chaphora	11.24	8-13-15	Highway Pav.& Const Co	15 ft. Concrete Base	107,073	5,552	112,625
W-138	V	"	2	D	Across Salinas R.			8-28-26	Atlas Const. Co.	Steel Bridge & App	39,397	1,718	40,115
M-252	V	"	2	D	Chaphora	Greenfield	11.78	4-13-27	Day Labor	Oil Treating Rock Borders	17,541		17,541
D-382	V	"	2	D,F,H	Excentions		1.24	8-25-21	Day Labor	15 ft. Concrete Base	32,410	365	32,775
133	V	"	2	E	3 Mi N.of King City Br	Greenfield	7.35	5-8-15	Highway Pav.& Const Co.	15 ft. Concrete Base	73,868	3,256	77,124
211	V	"	2	E	Thomasons Gulch Bridge		.32	12-19-18	Day Labor	Grading	1,446	31	1,477
216	V	"	2	E,F	San Lucas	Layout #25	11.10	1-9-18	Geo.S.Benson & Son	15 ft. Concrete Base	165,914	4,836	170,750
304	V	"	2	F	Across Salinas River		.50	6-18-19	Healy Tibbitts Const.Co.	Steel Bridge	308,212	5,783	313,995
156	V	"	2	F	King City	South Side Salinas R.	1.02	2-24-22	J.A. Costello, Jr.	Asph. Conc. Base & Surf.	29,728	997	30,725
D-192	V	"	2	F	King City Bridge			7-19-18	Day Labor	Test Borings	970		970
D-307	V	"	2	F	Salinas River Bridge		.52	6-18-20	Day Labor	Grading Approaches	4,066	63	4,129
436	V	"	2	F	Across San Lorenzo Cr.		0.25	1-23-24	Rocca & Caletti	R.C. Bridge & Gr. Appr.	29,636	2,777	32,413
D-589	V	"	2	F	At San Lorenzo Creek Br.		0.20	6-11-24	Day Labor	Rock Surfacing Approaches	Superseded		
D-593	V	"	2	F	At San Lorenzo Creek Br.		0.30	8-12-24	Day Labor	P.C.Concrete-Bridge Approach	13,453	557	14,010

COMPLETED CONTRACTS--JUNE 30, 1928—Continued

		Monterey				1/4 M. N. & W. [illegible] Jct.			Labor		$ 21,202	$ 29	$ [illegible]
		"				San Lucas			[illegible]		191,686	1,411	[illegible]
		"				San Lucas			[illegible]		3,653	222	[illegible]
		"				San Lucas			[illegible]		31,284	709	[illegible]
		"				San Lucas	10.05		[illegible]		127,078	1,578	[illegible]
		"				San Ardo	10.88		[illegible]				
		"				[illegible]	.72		[illegible]		32,661	695	[illegible]
		"				[illegible]			[illegible] Co.		93,015	1,016	[illegible]
		"				[illegible]	18.10		[illegible]		25,087	222	[illegible]
		"				[illegible]	18.10		[illegible]		15,023	204	[illegible]
		"				[illegible]			[illegible]		20,982	266	[illegible]
		"				[illegible]			[illegible]				
		"			Southern Boundary	3 Mi. N. of Bradley			[illegible]	15 ft. Concrete	289,583	809	[illegible]
		"	10		San [illegible]	2-3/4 M. E. Valley Sch			[illegible]	Grading & Rock	191,600	653	[illegible]
191		"	56		6 Mi. N. of San Simeon	Salsipuedes	1.30		[illegible]	Grading	309,674	955	[illegible]
		[illegible]											
995		[illegible]	56		Anderson Canyon	Bur Bur	18.06		Geo. Pollock Co.	Grading	1,097,001	[illegible]	[illegible]
		"			Various Locations (DM-1 | 51)				Minor Improvements	15,722	31	[illegible]
[illegible]	IV	Napa	[illegible]		Neate	Boundary	[illegible]		Day Labor	15 ft. Conc. Base	79,301	[illegible]	[illegible]
[illegible]	IV	"	[illegible]		Stanly	Road	[illegible]		Day Labor	15 ft. Concrete Base	31,414	[illegible]	[illegible]
[illegible]	IV	"	[illegible]		Napa	Napa	6.57		Warwick Const Co.	15' & 18' Concrete Base	149,162	[illegible]	[illegible]
[illegible]	IV	"	[illegible]		Napa	Napa	6.69		Rose Const. Co	Grad. & Rock Surfacing	296,692	[illegible]	[illegible]
	IV	"	59		Northern	Boundary	1-1/2 M. W. Calistoga						
	IV	"			Northern	Boundary	1-1/2 M. W. Calistoga		Day Labor	Rock Surfacing	20,430	17	[illegible]
	IV	"	56		1-1/2 M. W. Calistoga		Northern	Boundary	Day Labor	Border	1,176	11	[illegible]
	IV	"	56		Southern	Boundary	Rattlesnake	Creek	Day Labor	Stockpiling Materials	1,500	14	[illegible]
	IV	Napa-Sonoma	17		Southern	Boundary	Nevada	Line	A.J. Fairbanks	Grad. & [illegible] Base	201,498	[illegible]	[illegible]
	III	"	17		Southern	Boundary	Grass	Valley	Healy-Tibbitts Const. Co	15 ft. Bituminous Macadam	307,801	[illegible]	[illegible]
	III	Nevada-Placer	17		Bear	River							
	III	"	17		Bear	[illegible] Bridge			Security Bridge Co.	Steel Bridge	32,321	3,561	[illegible]
	III	"	17		Town	Line			Day Labor	Grad. Approaches	1,660	90	[illegible]
	III	"	17		Town	Line	[illegible]		Day Labor	Grad. & Conc. Paving	10,478	[illegible]	[illegible]
	III	"	17		Nevada	City	Northern	Boundary	Prison Labor	Grading	317,938	[illegible]	[illegible]
	III	"	35		Across S. Fork Yuba	River			Day Labor	Concrete Bridge	40,349	1,766	[illegible]
	III	Nevada-Sierra	29		Across [illegible]	Fork Yuba River							
	III	Nevada	29		Nevada	City	North San Juan		Day Labor	Concrete Bridge	29,311	1,301	[illegible]
	III	"	29		Nevada	City	Donner	Lake	Day Labor	Rock Surfacing	34,237	9	[illegible]
	III	"	37		Donner	Summit	Donner	Lake	J. Williamhurst & T. Macchia	Grading	197,187	[illegible]	[illegible]
426	III	"	38		Truckee		Boca		Irey & Holden	Grading	118,787	[illegible]	[illegible]
445	III	"	38		Across Truckee River, near		Polaris		Proctor & Cleghorn	Reinforced Concrete Bridge	52,017	[illegible]	[illegible]
470	III	"	38		Across Truckee River		At Prosser Creek		T.H. & M.C. Polk	R.C. Girder Bridge	18,313	[illegible]	[illegible]
471	III	"	38		Across Truckee River		Near Boca		Rocca & Colleti	Reinforced Concrete Bridge	30,912	1,196	[illegible]
[illegible]	III	"	38		Across Truckee River		At Prosser Creek		T.H. & M.C. Polk	Complete [illegible] and Br.	1,018		[illegible]
[illegible]	III	"	38		Approaches At Minton Xing	and Truckee R. Br.			Day Labor	Grading Approaches	2,287		[illegible]
9-650	III	Nevada-Sierra	38	A, B, A	Truckee		Nevada State Line		14.1	Hemstreet & Bell - Day Labor	Oil treated rock surfacing	45,267	851	[illegible]
468	III	"	38	B	Across Truckee River		near Truckee		[illegible]	McKay Engr. Co.	R.C. Girder Bridge	34,173	1,666	[illegible]
469	III	"	38	B	Across G.F. Truckee		near Truckee		[illegible]	T.H. & M.C. Polk	R.C. Girder Bridge	18,417	1,111	[illegible]
473	III	"	38	B	Boca		Floriston		1.72	Irey & Holden	Grading	331,194	13,087	[illegible]
474	III	Nevada-Sierra	38	B, A	Floriston		Nevada State Line		1.96	Nevada Contracting Co.	Grading	296,175	4,629	[illegible]
	III	"			Various Locations (DM-	7-111-A [illegible]				Minor Improvements	53,001	886	[illegible]
119	VII	Orange	2	A	San Juan Capistrano		Calivan		5.57	12-22-14	M. R. Gregory, Inc.	15 ft. Concrete Base	51,531	2,613	[illegible]
123	VII	"	2	A	U. S. 101		Norco		1.80	4- 6-15	Henshaw, Hinds Co.	Grading	57,959	3,040	[illegible]
378	VII	"	2	A	Southerly Boundary		San Juan Cr. Bridge		4.45	7-12-22	Sec. H. [illegible]	Asphaltic Conc. Pave.-Asph. Surf.	245,002	7,497	[illegible]
9-47	VII	"	2	A	Easterly Boundary		U. S. 101 & S. P. R. R.		3.56	10-24-14	Day Labor	15 ft. Concrete Base	38,[illegible]	1,618	[illegible]

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

Contract Number	Div.	County	Route	Sec.	From	To	Length Miles	Contract Date	Contractor	Type of Work	Contract Cost	Engr. Chgs.	Total
[illegible]	[illegible]	Orange	2	4	[illegible]	San Juan Creek	[illegible]	[illegible]	Day Labor	15 ft. Concrete Base	$ [illegible]	$ 1,[illegible]	$ [illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible]	[illegible]	[illegible]	[illegible]	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible]	Sierra	[illegible]	[illegible]	Day Labor	15 ft. Concrete Base	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible]	San Juan Creek	[illegible]	[illegible]	Day Labor	Oil Surfacing	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible]		[illegible]	[illegible]		15 ft. Concrete Base	[illegible]	113	[illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible]	San Juan	[illegible]	[illegible]	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible]			[illegible]	[illegible]	Bridge	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible] Creeks			[illegible]	[illegible]	[illegible]	16,[illegible]	1,[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible]		[illegible]	[illegible]	Day Labor	[illegible]	17,[illegible]	19	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	Irvine	[illegible]	[illegible]	[illegible]	15 ft. [illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] Shldrs.	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Day Labor	Oil Surfacing	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible] Bridge		[illegible]	[illegible]	Day Labor	Concrete [illegible] Trestle	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Grading & P.C.C. Pave.	202,088	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]			[illegible]	[illegible]	Reinf. Concrete [illegible]	28,184	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15' & 18' Concrete Base	59,841	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Conc. Pave. [illegible]	135,057		[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Day Labor	Oil Surfacing	5,904	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]		[illegible]	Day Labor	Grading [illegible]	1,919		[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]		[illegible]	[illegible]	[illegible] Co.	Grading & P.C.C. Pave	65,974	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	Anaheim	[illegible]	[illegible]	Day Labor	Topeka Surfacing	16,816	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Day Labor	18 ft. Concrete Base	1,350	24	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	Two Miles N. Santa Ana		[illegible]	[illegible]	Concrete [illegible] Bridge	110,489	4,078	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible] Boundary	[illegible]	[illegible]	[illegible]	18 ft. Concrete Base	94,705	2,731	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Day Labor	Topeka Surfacing	6,483	359	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible] Boundary	[illegible]	[illegible]	[illegible]	[illegible]	118,533	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible] Boundary	[illegible]	[illegible]	Day Labor	Oil Surfacing	5,637	680	[illegible]
[illegible]	[illegible]	[illegible]	2	4	[illegible]	[illegible]		[illegible]	Day Labor	[illegible]	3,383		[illegible]
[illegible]	[illegible]	Orange / Los Angeles	[illegible]	4, 5	See [illegible]								
[illegible]	[illegible]	Orange / Los Angeles	[illegible]	4, 5	See [illegible]								
[illegible]	[illegible]	Orange	[illegible]	4	[illegible] Bridge			[illegible]	Day Labor	[illegible]	4,172	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]	[illegible] 107+00		[illegible]	Day Labor	Appr. to Anaheim Bay [illegible]	41,795	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]	Huntington Beach		[illegible]	Day Labor	Set R/W Monuments	92		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]			[illegible]	[illegible] Ledbetter & Co.	Reinf. [illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]			[illegible]	[illegible] Ledbetter & Co.	Clean & [illegible]	2,858	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]	[illegible] Channel		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	A	[illegible]			[illegible]		[illegible]	9,408		9,408
[illegible]	[illegible]	Orange / Los Angeles	[illegible]	4, 5	See [illegible]								
[illegible]	[illegible]	Orange	[illegible]	A, B	[illegible]	[illegible] Beach	3.78	[illegible]	[illegible]	P.C. & [illegible] Pavement	214,208	9,[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	A, B	[illegible] Beach	[illegible]	8.80	[illegible]	[illegible]	Grading & Conc. Paving	211,178	11,[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] Beach	5.16	[illegible]	[illegible]	Grading	[illegible]	11,[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] Beach		[illegible]	[illegible]	[illegible]	Grading & P.C.C. Pave.	[illegible]	3,062	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	Day Labor	Concrete Culvert	835		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.42	[illegible]	[illegible] & Son	Grading & Rock Surface	[illegible]	13,[illegible]	[illegible]

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

	DIST	COUNTY	RTE	SEC	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	OTHER COST	TOTAL
[illegible]	VIII	[illegible]	[illegible]	[illegible]	At San Juan Creek Br				Day Labor	Bridge Imprvement	$	$ 2,000	$ 2,000
[illegible]	VIII	[illegible]	[illegible]	[illegible]	At Alder Creek Bridge			11- -27	Day Labor	Bridge Imprvement		200	200
[illegible]	VIII	[illegible]	[illegible]	[illegible]	Across San Juan Creek			2- -27	L. Wright & Day Labor	Timber Pile Trestle	12,895	695	13,590
[illegible]	VIII	[illegible]	[illegible]	[illegible]	At Sorrento Interpass			11- -27	F.H. Willing	Concrete Drainage System	4,253	324	4,577
[illegible]	VIII	[illegible]	[illegible]	[illegible]	Across E. Channel	San Juan Creek		10- 1-27	Day Labor	Payment to County	1,777		1,777
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Various Locations (EM-4-1-066-269-1931) (1931)					Minor Improvements	14,130		14,130
13	[illegible]	Placer	1	A	Southerly Boundary	Lincoln	8.90	9- -26	Burns, Clark & De Rosa	18 ft. Conc. Super-Skid Surf.	74,185	1,185	75,370
165	[illegible]	"	1	A	Auburn Ravine Pass		.12	4-18-28	Rose Concrete Co.	Sidewalk & Curb Inlet Assmy.	820		820
407	[illegible]	"	1	A	Roseville	Lincoln	4.97	12-1- -26	A.A. Santarello, Jr.	Asphaltic Surfacing	42,136		42,136
P-439	[illegible]	"	1	A	Roseville	Lincoln	5.00	3- 6-28	Day Labor	Concrete Shoulders	20,823	1,823	22,646
M-36	[illegible]	"	1	A	5 Mi.N. of Roseville	Lincoln	1.1	8-30-28	Kramer Paving Co.	Grad. & 2nd Stage Concrete	11,453		11,453
598	[illegible]	"	1	A	Across Antelope Ravine at Lincoln			5-10-28	Heidemer Const. Co.	Concrete Girder Bridge	21,442	1,326	22,768
3822	[illegible]	Placer-Sacto	1	A,B	See 03826 Sac-Pla-3-B,A								
156	[illegible]	"	1	B	Lincoln	Northerly Boundary	7.57	11- 8-26	C.H. & A.W. Correll	18 ft. Concrete Base	8,527	527	9,054
P-141	[illegible]	"	1	B	Yankee Slough Bridges (1 & 2)			7- 3-27	Day Labor	Grading	306		306
P-200	[illegible]	"	1	B									
P-465	[illegible]	"	1	B	Ahart, Berg & Yeware Slough Bridges		44	3-26-28	Day Labor	16 & 24 ft. Concrete Base	7,240	873	8,113
168	[illegible]	"	2	A	Through Meridian		2.28	3- -28	Day Labor	18 ft. Concrete Base	7,444	366	7,810
220	[illegible]	"	2	A	Roseville	Penryn	6.52	4-21-26	A.J. McLean Const. Co.	18 ft. Concrete Base	8,040		8,040
P-247	[illegible]	"	2	A	Through Penryn		1.45	5- -26	Day Labor	18 ft. Concrete Base	2,177		2,177
	[illegible]	"	2	A	Station 454+47	Station 504+00	.95	8- -28	Day Labor	15 ft. Concrete Base	1,645		1,645
181	[illegible]	"	2	B	Penryn	Auburn	1.48	1-11-28	A.J. McLean Const. Co.	18 ft. Concrete Base	4,901		4,901
285	[illegible]	"	2	B	Auburn	Northerly Boundary	7.47	6-15-27	Stimmelmayr & Vernon	Grad. & Bituminous Macadam	201,240	11,009	212,249
B-548	[illegible]	"	2	C	Auburn	Northerly Boundary	7.47	5-14-28	Day Labor	Seal Coat			
382	[illegible]	Placer-Nevada	2	C-A	See Const. 382 Nev-Pla-17-A, C								
B-538	[illegible]	" "	2	C-A	See Const. B-538 Nev-Pla-17-A,C								
181	[illegible]	"	2	A,B,C	Auburn	1/4 Mi. So. Colfax	16.58	7-26-27	C.H. & A.W. Correll	Grad. & 18' Untersound Mac.	451,174	24,193	475,367
D-585	[illegible]	"	2	A,B	Auburn	Colfax		6-11-28	Day Labor	R/W Monuments		73	73
411701	[illegible]	"	2	A,B	Near Applegate			10-12-27	W.A. Marshall Co.	Two Countersunk Rings	2,304	30	2,334
482	[illegible]	"	2	C	3/4 Mi. North Colfax	Dutch Ravine	4.03	6-11-28	C.B. Adams	Grading	39,655	1,545	41,200
D-652	[illegible]	"	2	C	Colfax	Dutch Ravine	9.0	3- 8-27	F.J. Swanson & Day Labor	Rock Surfacing	21,347	793	22,140
M-177	[illegible]	"	38	A	Tahoe City	Southerly Boundary	1.96	4- 3-28	Day Labor	Grading	27,040	1,024	28,064
M-49	[illegible]	"	38	A	Southerly Boundary	Tahoe City	8.8	10-1- -26	Day Labor	Clearing R/W	15	1,224	1,239
93821	[illegible]	"	38	A	Across Blackwood Creek			8- -27	Frank A. Heidemer	Reinf. Concrete Culvert	1,000		1,000
9382	[illegible]	"	38	A,C	Meeks Bay	Tahoe City	11.3	6-21-27	Hemstreet & Bell	Grading & Rock Surf.	40,746	434	41,180
M-89	[illegible]	Placer	38	A	Tahoe City	Nevada State Line	11.6	6-17-25	Blaney & Brooks	Rock Surfacing	34,470	470	34,940
	[illegible]	"			Various Locations (EM-1-066-254-263-272) (1931-4-8-10)					Minor Improvements	28,177	762	28,939
388	[illegible]	Plumas-Lassen	38	A	See Const. 388 Pl-Las-Plu-4-A								
P-405	[illegible]	" "	38	A	See Const. P-405 Pl-Lvk-Plu-4-A								
427	[illegible]	" "	38	A	See Const. 427 Pl-Lassen-Plumas 4-A								
526	[illegible]	"	38	A	Lake Almanor	Chester Grade		5- 1-28	C.B. Glendenning	Grading	12,041	1,528	13,569
P-455	[illegible]	"	38	A	Deer Creek Road	Chester & Mud Flat	1.57	8-14- -27	Day Labor	State's Share of Cost	15,000		15,000
D-363	[illegible]	Plumas-Tehama	38	A,B,C	Paynes Creek	Chester	4.09	4-11- -27	Day Labor	Grading	9,219		9,219
43	VIII	Riverside	39	A	Westerly Boundary	Riverside	9.32	10-24-13	M.J. Company, Inc.	18 ft. Concrete Pave.	4,886		4,886
D-31	VIII	"	39	A	Westerly Boundary	Riverside	9.32	3-11-15	Day Labor	Oil Surfacing	877		877
M-107	VIII	Riverside	39	A,B	(See M-107 VIII-San Bernardino Riverside 13-B,A								
409	VIII	[illegible]	66	A	In the City of Banning		.73	11-24-23	Southwest Paving Co.	Const. A 20' A.C. Pave.	21,671	740	21,771
M-555	VIII	"	66	A	Through Banning			10- 5-28	Day Labor	Reinforced Culverts		70	70
362	VIII	Riverside	86	A)	Beaumont		6.84	11- 6-19	H.H. Glenn	Grading	72,734	6,225	78,959
		San Bernardino	36	B)									

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

CONTRACT NUMBER	DIV.	COUNTY	RTE	SEC	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	CONST. ENGR.	TOTAL
											$	$	$
[illegible]	VIII	(Riverside (San Bernardino	26	A,B	(See Cont. 458 VIII-San Bernardino Riverside 26-B,A								
384	VIII	Riverside	26	B	Through the City of Banning		2.02	2- 9-22	Fred Teschke	Grad. & 16' Conc. Base	40,419	2,251	42,670
S-477	VIII	"	26	B	In the City of Banning		0.70	6-27-22	Day Labor	Concrete Curb	2,682	161	2,843
M-105	VIII	"	26	B	Beaumont	Banning	3.04	11-13-25	Geo. Herz & Co.	P. C. Concrete Pavement	82,858	3,232	86,090
358	VIII	"	26	C	Banning	Whitewater	12.30	4-12-22	Lee Moor Cont. Co.	16 ft. Concrete Base	262,593	9,685	272,278
464	VIII	"	26	C	Across San Gorgonio Wash			3-12-25	DeWitt & Morine	Reinforced Concrete Bridge	16,003	1,631	17,634
350	VIII	"	26	D	Whitewater	Edom	17.65	1-17-22	H.J. Kaiser	16 ft. Concrete Base	488,371	14,826	503,197
486	VIII	"	26	D	Whitewater River			8-16-23	Gibbons & Reed Co	Conc. Bridge & Approaches	120,492	4,531	125,023
M-126	VIII	"	26	D	Whitewater River	Edom	17.30	5-15-26	Watier Bros.	P.C.C.Pavement, Widening	111,379	2,367	113,746
351	VIII	"	26	E	Edom	Indio	11.47	1-17-22	Warren Const. Co.	16 ft. Asph Conc. Pave.	277,667	8,797	286,464
S-227	VIII	"	26	E	City of Indio		.71	4- 2-19	Day Labor	15 ft. Concrete Base	14,312	525	14,837
S-522	VIII	"	26	E	Flood Channels Coachella Valley Storm Water Dist.			12-19-22	Day Labor	2 Timber Trestles	4,732	59	4,791
M- 96	VIII	"	26	E	Edom	Indio	11.43	7-29-25	Basich Bros. Co.	P.C. Concrete Widening	108,503	3,465	111,968
477	VIII	"	26	E	Coachella-Stormwater Drain			7-29-25	Badt-Falk & Bergendahl	R.C.Girder Bridge	38,419	1,798	40,217
M-133	VIII	"	26	E,F	Indio	6 Mi. So Coachella	9.00	7-14-26	Southwest Pave. Co.	P.C.C.Wide & A.C. Surf.	189,462	8,974	198,436
S-215	VIII	"	26	F	N E Cor S 20.T 6 S.R.8 E	N.E.Cor.S.6,T.7 S.R.8 E	3.01	11-25-18	Day Labor	15 ft. Concrete Base	58,996	927	59,923
267	VIII	"	26	G	N.E Cor.S 6,T 7 S.R.8 E	Southerly Boundary	14.33	2- 4-20	Chas. D. Soteras	15 ft. Concrete Base	406,962	9,478	416,440
488	VIII	"	64	C	Desert Center	4 Mi.W.of Hopkins Well	21.00	11-30-25	F.C. Payton	Grading	27,584	2,476	30,060
509	VIII	"	64	D,E	Black Butte	Blythe	9.53	7-14-26	S.Y. Faucett	Grading & Rock Surf.	87,717	8,233	95,950
	VIII	"			Various Locations	(DM-136) (9HFF3)				Minor Improvements	323		323
12	III	Sacramento	3	A	Auburn Road	Northerly Boundary	1.85	9-25-12	Burns,Clark & De Roza	15 ft Conc.Base-Oil Surf.	15,714	2,730	18,444
S-412	III	"	3	A	Near Sylvan School			11-17-21	Day Labor	Removing Tree	240		240
S-432	III	"	3	B	At North Sacramento Trestle			2- 8-22	Day Labor	Boring & Test Pits	534	178	712
M- 67	III	"	3	B	Sacramento Northern	R.R. Crossing		4-15-25	Lord & Bishop	Underpass	20,000	933	20,933
M- 68	III	"	3	B	Western Pacific	R.R. Crossing		4-15-25	Lord & Bishop	Underpass	39,102	926	40,028
M- 98	III	"	3	B	American River	Globe Iron Works	0.42	9- 3-25	Kaiser Paving Co.	P.C. Concrete Pavement	29,126	2,170	31,296
DM- 96	III	"	3	B	At American River			1- 6-25	Day Labor	Rdwy. & Trestle App. Emb.	9,636	737	10,373
M-129	III	"	3	B	Globe Iron Works	El Camino Avenue	1.14	6- 8-26	Clark & Henery Const.Co.	Asph.Conc.Widening & Surf.	27,186	945	28,131
M-167	III	"	3	B	Ben Ali Crossing			4-13-27	Fredrickson-Watson Const.Co	Underpass	71,489	4,559	76,048
DM-187	III	"	3	B	At Sylvan School		0.25	11-10-26	Day Labor	Grading & Rock Surf.	4,351	434	4,785
91B24	III	"	3	B	Ben Ali Crossing		0.4	11- 1-27	C.W. Wood	Grading & P.C.C. Pave.	21,516	1,191	22,707
91B26	III	"	3	B	Three Crossings of Arcade Creek			7-28-27	Peter F. Bender	3 Reinf. Conc. Bridges	35,020	2,600	37,620
91B22	III	Sacto.-Placer	3	B,A	Sylvan School	Roseville	3.1	8-23-27	J.C. Compton	Asph. Concrete Pave.	104,073	5,686	109,759
M- 38	X	Sacramento	4	A	Southerly Boundary	R.R. Xing near Galt	1.89	1- 9-24	Kaiser Paving Co.	20'-24' Concrete Pavement	73,883	3,591	77,474
M- 90	X	Sacto-San Joaquin	4	A,D	Dry Creek Bridge			6-11-24	M.B. White	Floor repairs-Painting	15,785	1,033	16,818
M- 36	X	Sacramento	4	B	McDonnell Station	Sacramento	13.03	12-17-23	Kaiser Paving Co.	20-24 ft. Concrete Pavement	435,346	15,349	450,695
M- 143	X	"	4	B	Old Elk Grove	Sacramento		4-30-24	T.H. & W.C. Polk	12 Reinf. Concrete Bridges	47,202	3,418	50,620
M-100	X	"	4	B	Sacramento	1/2 Mile South	0.47	9-21-25	A. Teichert & Son	Asph. Conc. Pavement	20,131	1,239	21,670
112	III	"	11	A	Folsom	Easterly Boundary	6.83	11-10-14	A.W. & C.H. Gorrill	12 ft. Concrete Base	64,490	4,322	68,812
S- 71	III	"	11	A	Folsom	Easterly Boundary	6.83	8-26-15	Day Labor	Oil Surfacing	6,241	93	6,334
102	III	"	11	A	At Brighton Xing			11- 8-27	J.E. Tempest	Constructing Levees	5,357	121	5,478
S- 77	III	"	11	B	Through Folsom		.27	3-14-17	Day Labor	15 ft. Concrete Base	2,447		2,447
S- [illegible]	X	"	34	A	Clay	Easterly Boundary	8.43	5-10-21	Blumenkranz & Vernon	Grading	89,256	6,854	96,110
S- [illegible]	III	"			Sacramento			12-15-19	Day Labor	Maint.Bldg. & Shop Site			
S- [illegible]	X	Sacto-Amador	34	A,B	See S-523 X Amador-Sacramento 34-B,A								
DM- [illegible]	X	Sacramento	99	A	Rio Vista	Isleton	1.07	7- 8-25	Day Labor	Asph. Conc. Pavement	18,816	818	19,634
91B21	X	"	99	A	Across Sacramento R. at Rio Vista			6-23-27	Leonard T. Isham	Timber Bridge	68,572	1,660	70,232
	III-X	"			Various Locations	(DM-100-334) (9HEE11)					2,922	123	3,122
42	V	San Benito	2	A	Westerly Boundary	San Juan Bautista	4.22	10-29-13	E.O. Burge	Grading	47,298	3,263	50,561

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

No.	Dist.	County	Rte.	Sec.	From	To	Length	Date Awarded	Contractor	Type of Work	Contract Price	Extra Work	Total
[illegible]	V	San Benito	[illegible]	A	San Juan	[illegible] River	[illegible]	5- 2-22	W.A Dontanville	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	V	[illegible]	[illegible]	A	San Juan Bautista	Northerly Boundary	[illegible]	6-10-14	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	V	[illegible]	[illegible]	A	Westerly Boundary	San Juan Road	[illegible]	11- 6-15	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	V	[illegible]	[illegible]	A	Through San Juan Bautista	[illegible]	[illegible]	12- 7-15	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	V	[illegible]	[illegible]	A	Station [illegible]	Station [illegible]	[illegible]	9-26-17	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	V	[illegible]	22	A	San Juan Bautista	Hollister	[illegible]	5- 7-26	Granite Const. Co	[illegible]	[illegible]	[illegible]	[illegible]
	V	[illegible]	22	B)	Hollister	[illegible]	[illegible]	12-19-22	Granite Const. Co.	[illegible]	[illegible]	[illegible]	[illegible]
	IV	[illegible]	22	A)									
	V	San Benito	23	B	[illegible]	[illegible]	[illegible]	8-14-27	Geo. J. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	V	[illegible]	17	A	1/2 Mi. S. Soc. Route 2.	Pajaro Riv. Bridge	[illegible]	9-12-23	Granite Const. Co.	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	V	[illegible]	[illegible]	A	[illegible]	[illegible]	[illegible]	6-19-24	Rocca & Colletti	[illegible]	[illegible]	[illegible]	[illegible]
	V	[illegible]			[illegible]	[illegible]							
[illegible]	VIII	San Bernardino	[illegible]	A	[illegible]	Citrus Avenue	[illegible]	11-21-13	Hudson-Jetmann Const.Co.	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	VIII	[illegible]	[illegible]	A	At [illegible]	[illegible]	[illegible]	11-22-27	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	VIII	[illegible]	[illegible]	A,B,C	Cherry Avenue	San Bernardino	[illegible]	10-13-27	Steele Finley	[illegible]	[illegible]	[illegible]	[illegible]
D-5	VIII	[illegible]	[illegible]	B	Through Rialto	[illegible]	[illegible]	9-20-20	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	VIII	[illegible]	[illegible]	B,C	Fourth Avenue	San Bernardino	[illegible]	8-11-13	C.J. Flower	[illegible]	[illegible]	[illegible]	[illegible]
D-1	VIII	[illegible]	[illegible]	[illegible]	At Cajon Creek	[illegible]	[illegible]	9-10-17	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	VIII	[illegible]	[illegible]	[illegible]	[illegible] Boundary	Upland	[illegible]	2-26-14	Louis Ferrell	[illegible]	[illegible]	[illegible]	[illegible]
D-1	VIII	[illegible]	[illegible]	C	Westerly Boundary	Upland	[illegible]	6- 2-15	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
D-1	VIII	[illegible]	[illegible]	D	Through Upland	[illegible]	[illegible]	2-14-18	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	VIII	[illegible]	[illegible]	A,B	Westerly Boundary	Southerly Boundary	[illegible]	7-23-13	Bent & Pemstead	[illegible]	[illegible]	[illegible]	[illegible]
D-	VIII	[illegible]	[illegible]	B	Ontario	Southerly Boundary	[illegible]	10-20-14	Day Labor	[illegible]	[illegible]	[illegible]	[illegible]
M-1	VIII	San Bernardino	17	B	Ontario	Riverside	[illegible]	11-30-25	Steele Finley	[illegible]	[illegible]	[illegible]	[illegible]
		Riverside		A									
M-	VIII	San Bernardino	3	A	Santa Ana River	Red Hill	[illegible]	6- 3-25	Blanch Bros. Co.	[illegible]	[illegible]	[illegible]	[illegible]
	VIII	San Bernardino	3	B	1/3 Mi.N./S.W. Co. Line	Devore	[illegible]	11-15-24	Blanch Bros. Co.	[illegible]	[illegible]	[illegible]	[illegible]
		Riverside		A									
	VIII	San Bernardino	3	B	See Dist. VI-Riv-3-A & San-3-B								
		Riverside		A									
[illegible]	VIII	San Bernardino	3	B	Redlands	1/3 Mi.N.Riv.Co. Line	4.8	9-30-27	Matich Bros.	Grading & [illegible]	165,734	[illegible]	172,319
M-2	VIII	[illegible]	[illegible]	A	San Bernardino	Westbound	5.5	2-23-27	Day Labor	Rock Base	5,889	[illegible]	5,889
[illegible]	VIII	[illegible]	[illegible]	[illegible]	Summit	Victorville	15.74	10- 5-21	R.T. Shea & Co.	16 ft. Bit. Macadam	322,189	[illegible]	132,809
[illegible]	VIII	[illegible]	[illegible]	E,F	Victorville	Barstow	36.50	3- 5-21	Day Labor	Road Improvement	23,563	[illegible]	24,229
[illegible]	VIII	[illegible]	[illegible]	E,F	Victorville	Oro Grande	25.74	7-29-25	H.G. Fenton	Grade & Base Surface	163,627	[illegible]	174,115
[illegible]	VIII	[illegible]	[illegible]	F	Through Barstow	[illegible]	0.27	11-24-25	Day Labor	Drainage and Bit. Pavement	5,273	34	5,309
M-1	VIII	[illegible]	[illegible]	G,H	Daggett	Field	20.6	4-13-26	Day Labor	Grading	47,476	169	47,645
[illegible]	VIII	[illegible]	[illegible]	F,E	1/2 Mi. W. of Barstow	1 Mi. E. Barstow	2.32	12-13-24	H.W. Herring	Grade	15,446	1,551	17,997
[illegible]	VIII	[illegible]	[illegible]	F,E	Hicks	Daggett	18.52	11-30-26	Ken Hodgson	[illegible] & Rock Surfacing	158,436	1,079	165,521
[illegible]	VIII	[illegible]	[illegible]	E,F	Helendale	Daggett	27.6	4-13-27	Day Labor	Grading, Rock Surfacing	34,599	60	34,659
M-	VIII	[illegible]	[illegible]	J	Field	Summit	7.1	3- 9-27	Day Labor	Grading	5,149	16	5,165
M-	VIII	[illegible]	[illegible]	A	Running [illegible] Park Westerly		2.98	7-22-26	Day Labor	Grading	25,000	1,671	26,671
M-	VIII	[illegible]	[illegible]	A	Running [illegible] Park Westerly		2.98	5- 4-27	Day Labor	Grading	9,630	660	10,290
[illegible]	VIII	[illegible]	[illegible]	A	Running [illegible] Park Westerly		2.98	6-30-27	Day Labor	Grading	15,929	993	16,922
M-	VIII	[illegible]	[illegible]	C	Big Bear Lake	Fawnskin	3.27	9-21-25	W.S. Ross	Grading	35,940	1,078	36,018
[illegible]	VIII	[illegible]	[illegible]	[illegible]	Barstow	Newberry	162.00	3- 5-24	Day Labor	Road Improvement	25,243	[illegible]	25,7
M-	VIII	[illegible]	[illegible]	[illegible]	At San Bernardino	[illegible]	[illegible]	2-13-25	Houghton & Anderson	Maint. Shop Bldg. & Shed	[illegible]	[illegible]	[illegible]
[illegible]	VIII	[illegible]	[illegible]	[illegible]	Minneola	Hesper	20.53	4-27-26	Day Labor	Grading & Rock Surfacing	57,000	336	[illegible]
M-	VIII	[illegible]	[illegible]	E,F	Near Ludlow	[illegible]	12.00	8-20-25	Day Labor	Rock Surfacing	[illegible]	[illegible]	[illegible]
	VIII	[illegible]	[illegible]	[illegible]	At San Bernardino	[illegible]	[illegible]	7-30-26	George Hart & Co.	Office Building	28,936	1,000	[illegible]

UNIT NO. OR PROJECT NUMBER	DIV.	COUNTY	ROUTE	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	CONST. ENGR.	TOTAL
	VIII	San Bernardino			Various Locations	(SM-171-182-1[illegible])(SBB-11-13)				Minor Improvements	$ 23,984	$ 2	$ 23,986
7	VII	San Diego	2	A	San Diego	Encinitas	8.42	8-27-12	M.L. Curtis & Co.	15 ft. Conc.Base-Oil Surf.	69,638	3,929	73,567
D-298	VII	" "	2	A	At Escondido Cr. Bridge		.34	1-22-20	Day Labor	15 ft. Concrete Base	1,773	73	1,846
DM-241	VII	" "	2	A	Across San Dieguito Slough			3- 9-27	Mercereau Bridge Const.Co.	Timber Pile Trestle	8,667	307	9,974
M-135	VII	" "	2	A	At Del Mar Crossing			7-30-26	John Short	Reinf. Concrete Bridge	31,634	2,358	33,992
97701	VII	" "	2	A	At Del Mar Crossing			6-23-27	John & Bressi Const. Co.	Approaches to Bridge	64,762	5,664	70,426
DM- 42	VII	" "	2	A,B				1-11-24	Day Labor	Culverts Extended			
M- 36	VII	" "	2	A,B	San Diego	Oceanside	17.94	1- 9-24	John & Bressi	Shldr. & 2nd Story Conc.	551,734	19,004	570,738
30	VII	" "	2	B	Encinitas	Oceanside	10.63	5-21-13	J.M. Montgomery	15 ft. Concrete Base	84,248	4,017	88,265
221	VII	" "	2	B	Through the City of Oceanside		1.91	3-13-18	E.S. Groshong	15' & 20' Concrete Base	23,913	1,165	25,078
D-352	VII	" "	2	B	At San Marcos Creek			2- 2-21	Day Labor	Paving Approaches	4,995	38	5,033
M-111	VII	" "	2	B	Across A.T.& S.F.R.R.	Near Carlsbad		12-14-25	Coon Bros.	Reinforced Conc. Girder Br.	20,104	2,494	22,598
M-159	VII	" "	2	B	At Carlsbad Crossing		0.26	2- 7-27	Charles E. Crowley	Grading & Rock Surf.	17,444	1,561	19,005
D- 11	VII	" "	2	B,C	Encinitas	Las Flores	18.48		Day Labor	Oil Surfacing	32,240	1,892	34,132
M- 93	VII	" "	2	B,C,D	Oceanside	2 Mi. S. of San Onofre	14.93	7-13-25	John & Bressi	P.C.C. Pavement & Widening	564,383	18,517	582,900
39	VII	" "	2	C	Oceanside	Las Flores	8.03	9-24-13	C.L. Hyde Const. Co.	15 ft. Conc. Base	69,069	2,974	72,043
D-187	VII	" "	2	C	At Las Flores Cr. Br.			2-14-18	Day Labor	Grading	463		463
D-237	VII	" "	2	C	At San Marguerita R. Br.		.08	6-11-19	Day Labor	Grading	2,378	7	2,385
457	VII	" "	2	C	Across Sycamore Cr.			10- 6-24	H.H. Peterson	Reinf. Conc. Arch Bridge	10,847	1,737	12,584
DM-190	VII	" "	2	C	At Oceanside Underpass			11-16-26	State Share	Underpass	17,571		17,571
M-156	VII	" "	2	C	Across Las Flores Creek			10-29-26	Sidney Smith	Reinf. Concrete Bridge	29,712	2,386	32,098
D-402	VII	" "	2	C,D	Oceanside	Northerly Boundary		10-20-21	Day Labor	Rebuilding R/W Fence	5,750	238	5,988
58	VII	" "	2	D	Las Flores	Westerly Boundary	11.14	4-22-14	W.A. Perry	15 ft. Concrete Base	107,160	8,035	115,195
D- 58	VII	" "	2	D	Las Flores	Westerly Boundary	11.14	8- 6-15	Day Labor	Oil Surfacing	15,208	150	15,358
D- 80	VII	" "	2	D	At Sta. 0+00 & Sta. 0+97		.05	10-25-15	Day Labor	15 ft. Concrete Base	7,679	293	7,972
M- 83	VII	" "	2	D	San Onofre	Westerly Boundary	3.65	6- 3-25	R.A. Watteon	P.C. Concrete Pavement	125,380	6,263	131,643
466	VII	" "	2	D	Across San Onofre Cr.			5- 4-25	Fluor Const. Co.	Reinforced Concrete Bridge	55,595	2,680	58,235
467	VII	" "	2	D	Across San Mateo Cr.			6- 3-25	R.A. Watteon	Reinforced Concrete Bridge	73,820	2,397	76,217
DM-232	VII	" "	2	D	At Las Flores Underpass			2-23-27	Day Labor	P.C.C. Pavement	6,303	150	6,453
59	VII	" "	12	A	East San Diego	La Mesa	1.96	4-22-14	C.L. Hyde Const. Co.	15 ft. Concrete Base	19,464	1,581	21,045
217	VII	" "	12	A	Through East San Diego and	La Mesa	4.15	1-24-18	David H. Ryan	15 ft. Concrete Base	56,241	2,012	58,253
DM-357	VII	" "	12	A	University Ave.	El Cajon Ave.	0.5	5- 9-27	State share	Asph. Concrete Pave.	5,719		5,719
DM-270	VII	" "	12	A	At La Mesa		0.75	6-17-27	State share	Asph. Concrete surfacing	13,592		13,592
9775	VII	" "	12	A	San Diego	La Mesa		9-16-27	State share	Asph. Concrete surfacing	45,512	2,656	48,168
9777	VII	" "	12	A	At La Mesa			11-29-27	State share	Asph. Concrete surfacing	1,364		◆ 1,364
D- 28	VII	" "	12	A,B	East San Diego	El Cajon	3.52	1-22-15	Day Labor	Oil Surfacing	5,006	561	5,567
M-163	VII	" "	12	A,B	La Mesa	El Cajon	3.69	3- 9-27	Geo. Herz & Co.	Grading & P.C.C. Pave.	161,921	9,254	170,175
94	VII	" "	12	B	La Mesa	El Cajon	1.56	8-26-14	C.L. Hyde Const. Co.	15 ft. Concrete Base	16,880	952	17,832
223	VII	" "	12	B	Through El Cajon		2.41	4-10-18	W.E.Hall & R.L.Baskerville	15' & 20' Concrete Base	31,470	1,219	32,689
D- 93	VII	" "	12	C	El Cajon	Flinn Springs	7.23	12- 6-17	Day Labor	15 ft. Concrete Base	77,646	1,920	79,566
D-180	VII	" "	12	C	Station 530	Station 698	3.18	3- 9-17	Day Labor	Grading	26,542	212	26,754
D-181	VII	" "	12	C	Station 424+34.48	Station 765+58	3.48	1-16-18	Day Labor	Grading	20,567	904	21,471
269	VII	" "	12	C,D	Flinn Springs	Ogden Ranch	11.27	5- 7-20	Riley & Peterson	15 ft. Concrete Base	308,655	11,453	320,108
204	VII	" "	12	D	Guatay Creek	Pine Valley	4.55	9-11-17	W.W. Ledbetter	Grading	27,033	2,313	29,346
219	VII	" "	12	D	3 Mi. E. of Willows	Sweetwater River	3.74	3-13-18	Maurice Ryan	Grading	74,357	2,738	77,095
D-106	VII	" "	12	D	Viejas Creek	Guatay Creek	2.36	7-26-16	Day Labor	Grading	26,011	828	26,839
D-166	VII	" "	12	D	At Viejas Cr. Bridge & near	Sta. 177+30		10- 6-17	Day Labor	Grading	774	8	782
D-180	VII	" "	12	D	1 Mi. West of Alpine	Viejas Creek	2.65	1-16-18	Day Labor	Grading	10,801	387	11,188
D-193	VII	" "	12	D	At Sweetwater River Br.			5-23-18	Day Labor	Grading	951	9	960
D-453	VII	" "	12	D	Viejas	Easterly		4-16-22	Day Labor	18 ft Concrete Base	26,506	131	26,637

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

Number	Dist.	County	Rte.	Sec.	From	To	Length in Miles	Date of Contract	Contractor	Type of Work	Contract Price	Extra Work	Total
[illegible]	VII	[illegible]	[illegible]	[illegible]	At [illegible] Creek		[illegible]	[illegible]	Standard Paving Co.	Paving Bridges	$ 43,432	$ 703	$ [illegible]
[illegible]	VII	[illegible]	[illegible]	B,F	Beautification Grade	Line Sec Barrington	[illegible]	[illegible]	Day Labor	Concentrated Granite Surf.	[illegible] 500		[illegible]
[illegible]	VII	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Fencing	[illegible] 478	4,027	[illegible]
[illegible]	VII	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Day Labor	Fencing	[illegible] 768	231	[illegible]
[illegible]	VII	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Day Labor	Fencing	[illegible] 739	265	[illegible]
[illegible]	VII	[illegible]	[illegible]	F	[illegible]	[illegible]	[illegible]	[illegible]	Wright & Dennis	Grading	[illegible] 486	11,082	[illegible]
[illegible]	VII	[illegible]	[illegible]	F	At [illegible]		[illegible]	[illegible]	Day Labor	Surface Oiling	[illegible] 474	20	[illegible]
[illegible]	VII	[illegible]	[illegible]	F	At La [illegible] Creek		[illegible]	[illegible]	Day Labor	Retaining Wls. & Appr. Fences	[illegible] 712		[illegible]
[illegible]	VII	[illegible]	[illegible]	F	At [illegible] Slough		[illegible]	[illegible]	Day Labor	Concrete Piling	[illegible] 179		[illegible]
[illegible]	VII	[illegible]	[illegible]	F	Over G.C. & A. Ry. near [illegible]		[illegible]	[illegible]	W.M. Lindstrom	Concrete Crossing	[illegible] 630	548	[illegible]
D-231	VII	[illegible]	[illegible]	G	Tecate [illegible]	Easterly Boundary	15.21	[illegible]-12-19	Day Labor	[illegible] ft. Concrete Base	[illegible]	11,457	[illegible]
D-288	VII	San [illegible]	[illegible]	G	See Section VII-[illegible]-G [illegible]								
		[illegible]											
482	VII	San [illegible]	101	B	Mountain Springs Grade		1.90	[illegible]-21-25	A.R. McGrath	Grading	[illegible] 65, [illegible]	5,47[illegible]	[illegible]
		[illegible]		A									
515	VII	[illegible]	101	B	Mountain Springs Grade	Monarch Dr. Br	0.80	8-14-28	Johns & Brown Const. Co.	Grading & P.C.C. [illegible]	378, [illegible]	14,0[illegible]	[illegible]
				A									
	VII	San [illegible]			Various Locations (D M-[illegible]-71-[illegible]) (VII-[illegible])					Water Installations	12,111		[illegible]
349	IV	[illegible]	80	A	Sloat Boulevard	Seventh Road	7.34	12-21-25	F.D. Burr	Grading & Rock Surfacing	34,[illegible]	20,6[illegible]	[illegible]
		[illegible]											
D-561	IV	[illegible]	55	A	Sloat Boulevard	Fort Funston Road		11-[illegible]-27	Day Labor	Guard Rail	1,[illegible]	[illegible]	[illegible]
D-430	IV	[illegible]	55	A	Sloat Boulevard	Seventh Road		[illegible]-[illegible]-28	Day Labor	Curbs, Sidewalks & [illegible]	[illegible]	[illegible]	[illegible]
		[illegible]											
D-563	IV	[illegible]	55	A	Sloat Boulevard	Seventh Road	7.3[illegible]	12-[illegible]-27	Day Labor	Rock Surfacing	13, [illegible]	77	14,[illegible]
		[illegible]		B									
D-238	X	[illegible]	[illegible]	A	At [illegible] A Manteca		[illegible]	[illegible]-[illegible]-[illegible]	Day Labor	[illegible] ft. Concrete Base	65,[illegible]	2,[illegible]	[illegible]
D-279	X	[illegible]	[illegible]	A	[illegible] River Bridge		[illegible]	[illegible]-[illegible]-[illegible]	Day Labor	Timber Surfacing	2,[illegible]	[illegible]	[illegible]
M- 66	X	[illegible]	[illegible]	A,4	[illegible], Boundary	Turner Station	10.[illegible]	[illegible]-[illegible]-[illegible]	J. F. Knapp	[illegible] Pavement & Appurts.	298, [illegible]	10, [illegible]	[illegible]
D-279	X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]-[illegible]-[illegible]	Day Labor	[illegible] ft. Concrete Base	11, [illegible]	[illegible]	11,[illegible]
711802	X	[illegible]	[illegible]	[illegible]	Salton Junction Diverting Canal		[illegible]	[illegible]-[illegible]-[illegible]	Frederickson Bros.	Concrete Surface	25, [illegible]	1,[illegible]	[illegible]
713821	X	[illegible]	[illegible]	[illegible]	[illegible]	Chemehuevi Spr.	[illegible]	[illegible]-[illegible]-27	Isley & Holden	Grading & Rock Surf.	36, [illegible]	4,[illegible]	[illegible]
296	X	[illegible]	[illegible]	[illegible]	[illegible]	Northerly Boundary	[illegible]	[illegible]-[illegible]-[illegible]	W.A. Dontanville	[illegible] ft. Concrete Base	43, [illegible]	3,6[illegible]	[illegible]
D-341	X	[illegible]	[illegible]	[illegible]	At [illegible] & [illegible]		[illegible]	[illegible]-[illegible]-[illegible]	Day Labor	Imp. Br. Approx. & Access Road	2, [illegible]		[illegible]
M- 50	X	San Joaquin	[illegible]	[illegible]	[illegible]								
		Sacramento		A									
M-16)	X	San Joaquin	[illegible]	A	Tracy	1/4 Mile East	[illegible]	[illegible]-[illegible]-[illegible]	J.A. Pomello Jr.	[illegible] ft. Conc. Base, Surface	13,800		10,800
M- 27	X	[illegible]	[illegible]	A	[illegible], Boundary	Manta	[illegible]	[illegible]-[illegible]-[illegible]	Isley & Holden	Reinforced Conc. Structure	44,314	1,348	45,662
M- 56	X	[illegible]	[illegible]	A	[illegible], Boundary	Manta	[illegible]	[illegible]-[illegible]-[illegible]	[illegible] Paving & Const. Co.	Asph. [illegible] & Surface	212,142	[illegible] 572	217,514
D-269	X	[illegible]	[illegible]	A	[illegible]	French Camp	[illegible]	[illegible]-[illegible]-[illegible]	Day Labor	[illegible] ft. Timber Base	57,453	1,883	59,336
D-362	X	[illegible]	[illegible]	A	Interurban Rwy Cut Bridge		[illegible]	[illegible]-[illegible]-[illegible]	Day Labor	Grading	566		566
D-381	X	[illegible]	[illegible]	B	At [illegible] Bridge			[illegible]-[illegible]-27	Day Labor	Deck Repairs	2,571	161	2,733
M- 66	X	[illegible]	[illegible]	B	At [illegible]		[illegible]	[illegible]-[illegible]-[illegible]	[illegible]-Schmidt Elec. Co.	Bridge Repairs	193,593	12,871	206,464
M-158	X	[illegible]	[illegible]	B	At [illegible]			[illegible]-[illegible]-[illegible]	J.E. Johnston	Grading	25,484	3,007	28,491
712201	X	[illegible]	[illegible]	B	At [illegible]			[illegible]-[illegible]-[illegible]	Warner Foundry & Co.	Reinforcing Steel	3,300	315	3,615
711825	X	[illegible]	[illegible]	B	At [illegible]			[illegible]-[illegible]-[illegible]	Fredrickson & Watson Constr. Co.	Underpass	19,343	1,690	21,033
556	X	[illegible]	[illegible]	A	1.1 Mi. E. of [illegible]	Easterly Boundary	4.[illegible]	[illegible]-[illegible]-[illegible]	Hunt Bros.	Const. & Rock Surfacing	34,702	3,423	38,125
		[illegible]	[illegible]		[illegible]					Water Improvements	6,145		6,145
[illegible]	[illegible]	San [illegible]	[illegible]	[illegible]	[illegible]	Northerly Boundary	10.[illegible]	[illegible]-[illegible]-[illegible]	W.A. Dontanville	[illegible] ft. Conc. Surface; Surf.	127,138	5,594	132,683
D-1[illegible]	V	[illegible]	[illegible]	A	At [illegible] 12, 17, 83 & 2[illegible]		[illegible]	[illegible]-[illegible]-[illegible]	Day Labor	[illegible] ft. Concrete Base	3,147	19	3,166
1[illegible]	V	[illegible]	[illegible]	D	[illegible]	Pisgo Station	10.[illegible]	[illegible]-[illegible]-[illegible]	[illegible]	[illegible] ft. Concrete Base	117,530	[illegible] 302	122,832

CONTRACT NUMBER	DIV.	COUNTY	RTE	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	CONST. ENGR.	TOTAL
DM- 51	IV	San Mateo	2	A	Thru Daly City			2-11-26	Day Labor	P.C. Concrete Widening	$ 6,287	$ 688	$ 6,975
M-148	IV	" "	2	A	Colma	Cypress Lawn Cemetery	1.51	10- 7-26	Kaiser Paving Co	Grading	127,883	15,191	143,074
94201	IV	" "	2	A	Colma	Cypress Lawn Cemetery	1.51	6-25-27	Hannaman Co.	P. C. Concrete Pave.	192,249	8,701	200,950
DM-152	IV	" "	2	A	Colma	Cypress Lawn		6-14-26	Day Labor	Grading, (Relocate Spur)	243		243
M- 25	IV	" "	2	A,B	San Bruno	Beresford	5.13	8-27-23	Pac.States Const.Co	Con Sdlrs.& Asph.Conc.Surf	306,676	5,957	312,633
22	IV	" "	2	B	Redwood City	Southerly Boundary	3.29	3-26-13	S. P. Doyle	24 ft. Topk. on Macadam	50,991	2,637	53,628
27	IV	" "	2	B	San Mateo	Beresford	1.76	4-23-13	Raisch Improvement Co.	20 ft. Topk. on Macadam	29,211	1,896	30,107
167	IV	" "	2	B	Beresford	Redwood City	4.24	7-10-16	J. A. Marshall	20 ft. Concrete Base	78,750	4,638	83,388
280	IV	" "	2	B	Beresford	Redwood City	4.24	5-10-21	Pac.States Const Co	20 ft. Asph. Conc. Surf	60,041	1,922	63,963
D- 9	IV	" "	2	B	At San Francisquito Creek		.18		Day Labor	20 ft. Bit. Concrete	6,904	235	6,139
D- 26	IV	" "	2	B	Redwood City	Southerly Boundary		10-24-14	Day Labor	Retaining Wall	1,082	352	1,434
D-339	IV	" "	2	B	Beresford	Redwood City	4.24	4-23-29		Conc Shldrs ,Topeka Surface	273		273
D-350	IV	" "	2	B	Beresford	Redwood City	4.24	12- 8-30	Day Labor	Concrete Shldrs	52,533	1,360	53,893
M- 49	IV	" "	2	B	Redwood City	Southerly Boundary	3.46	6-11-24	Freeman & Whiting	Mac Shldrs. & A. C Surf	129,900	8,374	138,274
DM- 39	IV	" "	2	B	Redwood City	Southerly Boundary		7-30-24	Day Labor	Smooth Pav. Edge			1,450
DM-139	IV	" "	2	B	Beresford	Redwood City	4.26	5- 1-26	Day Labor	Extend Culverts	4,996	47	5,002
M-157	IV	" "	2	B	Thru Hillsborough		0.23	8-16-26	Municipal Imp. Co	P.C.C.Widening & Asph.Conc Surf	6,925	1,024	7,949
349	IV	(San Mateo (San Francisco	55	A	See Cont. No. IV-SF-SM-55-A								
D-630	(IV (IV	San Mateo San Francisco	55 55	A) A)	(See D-630-S.F.S.M.)								
404	IV	San Mateo	55	A,B	Sneath Road	Halfmoon Bay	13.47	11- 1-22	P. L. Bury	Grad. & Rock Surfacing	441,435	33,611	475,046
481	IV	" "	55	A,B,C	Northerly Boundary	Kings Mountain Road		9- 3-25	Samuel A. Martindale	Guard Rail	10,530	459	10,989
482	IV	" "	55	B	Crystal Springs Dam		.11	7- 9-23	J. F. Sheperd	Reinforced Concrete Bridge	50,215	1,680	51,895
D-577	IV	" "	55	B	Station 165+75			3-19-24	Day Labor	Labor on Drainage Structure	248	2	250
D-563	IV	(San Mateo (San Francisco	55	B) A)	See Cont. D-563 IV-S.F-S.M-A-B								
439	IV	San Mateo	55	C	Half Moon Bay Road	La Honda Road	12.3x	3- 5-24	J. P. Holland	Grad. & Rock Surfacing	572,157	35,735	607,892
94804	IV	" "	68	A	Visitacion Valley	South San Francisco (Por.)		11- 4-27	Federal Const. Co.	Asph Concrete Surfacing	14,883	258	15,141
448	IV	" "	68	B	South San Francisco	Broadway Station	5.21	8- 4-24	D. A. Foley & Co	Grading	356,612	17,043	373,655
D-627	IV	" "	68	B				5-10-26	Day Labor	Repaire to Tide Gates	6,054	140	6,185
D-629	IV	" "	68	B	South San Francisco	Burlingame		5-10-26	Day Labor	Maintaining Drainage Canals	532	2	534
501	IV	" "	68	B	So San Francisco	San Mateo		5-27-26	Lozier & Carr	Right of Way Fence	8,440	701	9,141
511	IV	" "	68	B	At So San Francisco			7-30-26	Barrett & Hilp	Underpass	253,225	9,121	262,346
518	IV	" "	68	B	So. San Francisco	Burlingame		12-15-26	Healy-Tibbetts Const.Co.	Bridge Repairs	6,446	267	6,713
D-633	IV	" "	68	B	So. San Francisco	Broadway Station		9-28-26	Barrett & Hilp	Grading	7,678	485	8,163
94701	IV	" "	68	B	So San Francisco	Broadway Station	5.2	12- 6-27	Granfield-Farrar-Carlin	Grading & Rock Surf	129,177	6,088	135,265
94Y2	IV	" "	68	B	At So San Francisco			9- 1-27	Day Labor	Asph. Conc. Pavement	880		880
	IV	" "			Various Locations (DM-110-[illegible])					Minor Improvements	19,232	120	19,352
95	V	Santa Barbara	2	A	Orcutt	Santa Maria River	6.49	8-26-14	A.S.Bent Const Co.	15 ft. Topk on Concrete	98,806	3,212	102,018
255	V	" "	2	A	Orcutt	1 Mi. So Divide	3.56	9- 3-19	Frank C. McIntire	15 ft. Concrete Base	77,955	3,554	81,509
D- 72	V	" "	2	A	Santa Maria	Santa Maria River	.82	12- 7-15	Day Labor	Oiled Gravel	750	22	772
D-283	V	" "	2	A	Orcutt	1 Mi. So Divide		8- 5-19	Day Labor	Stockpiling	4,279		4,279
D-322	V	" "	2	A,D,E	Exceptions			4- 2-20	Day Labor	15 ft. Concrete Base	3,488	14	3,502
95B03	V	" "	2	A,B,C	Orcutt	Zaca	24.0	11-10-27	J. F. Collins	Rock Borders	61,665	1,203	62,868
D-366	V	" "	2	A,C	Exceptions		1.20	4-28-21	Day Labor	15 ft. & 18 ft. Conc.Base	33,050	529	33,579
36	V	" "	2	B	Los Alamos	Bicknell	11.95	7- 3-13	Mayer & Lewis	19 Conc. Base-Oil Surf	146,326	10,482	156,808
134	V	" "	2	C	Zaca Station	Los Alamos	8.75	6- 6-17	W.A.Contanville	15 ft.Concrete Base	123,630	7,779	131,409
D-305	V	" "	2	C	Through Los Alamos		.19	4-22-20		Widening Pavement	193	3	196
D-327	V	" "	2	C	Through Los Alamos			10-25-22	Day Labor	Widening Pavement	1,654		1,654
D-131	V	" "	2	C,D	Gaviota	Los Alamos		3-19-17	Day Labor	Cattle Passes	1,454	3	1,457
133	V	" "	2	D	Gaviota Pass	Zaca Station	11.39	8-10-15	C. H. Hudson	Grading	64,658	5,123	69,781

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

[illegible]	Dist.	County	Rte.	Sec.	From	To	Length Miles	Completed Date	Contractor	Type of Work	Contract Amount	Subsequent Expenditures	Total Cost
176	V	Santa Barbara	2	D	At San Ynez River		.02	9-11-16	Werner-Pfrimmer Co.	Steel Bridge	$ 174,992	$ [illegible]	[illegible],230
[illegible]118	V	"	2	D	Zaca Canyon Bridges		.02	2-13-17	Day Labor	[illegible]	3,567	[illegible]	3,589
[illegible]155	V	"	2	D	At Wojcoul Creek Bridge	Sta. 134+30	.06	6- 1-17	Day Labor	Timber Approaches	1,018	[illegible]	1,023
279	V	"	2	D,E	Las Cruces	Zaca Station	14.04	3- 3-21	Pacific Coast Engineering Co.	15 ft. Conc. Pave.	455,651	[illegible]	471,870
[illegible]326	V	"	2	D,E	Las Cruces	Zaca Station	14.04	4- 2-20	Day Labor	Shoestring Conc. Approach	98,786	[illegible]	100,932
115	V	"	2	E	Alcatraz	Las Cruces	4.82	12- 8-14	J.W. Caldwell	15 ft. Concrete Base	104,012	[illegible]	109,588
182	V	"	2	E	Las Cruces	Gaviota Pass	2.91	5-22-17	Ira Hudson	Grading	65,156	[illegible]	67,944
[illegible]134	V	"	2	E	At Gaviota Canyon Bridges		.14	6- 4-17	Day Labor	Grading Approaches	2,620	[illegible]	2,734
[illegible]180	V	"	2	E	Alcatraz	Las Cruces	.46	6-19-17	Day Labor	15 ft. Conc. Base	6,095	[illegible]	6,165
516	V	"	2	E	Across Gaviota Creek			11-16-26	Geerg Bean.	Reinf.Concrete Arches	22,529	[illegible]	24,883
[illegible]701	V	"	2	E	At Gaviota Creek Bridge		0.3	7-28-27	Ira Hudson Sr & E T. Dooley	Grading & road widening	10,597	[illegible]	10,032
941	V	"	2	E,F,G	(Los Chiqueros Creek (2-1/2 Mi.E of Gaviota	Gaviota Creek (Cuesta de Las Llagas)	8.41	11-29-21	Southwest Pav. Co.	(Conc.Shldrs. and) (Asphalt Surfacing)	234,581	[illegible]	[illegible],998
[illegible]M-59	V	"	2	[illegible]F,G	Gaviota	Goleta	24.64	6- 4-25	Day Labor	Widen. Grade	39,993	[illegible]	39,716
62	V	"	2	F	El Capitan Creek	Alcatraz	0.31	8-11-14	T.K. Beard	Grading	97,408	[illegible]	101,695
197	V	"	2	F	El Capitan Creek	Alcatraz	0.34	8- 9-17	Bryan & Brain	15 ft. Concrete Base	123,597	[illegible]	128,336
229	V	"	2	F	At Arroyo Honda		.10	7-16-18	W.M.Lechleitner & Co.	Concrete Bridge	87,019	[illegible]	88,809
[illegible]172	V	"	2	F	Refugio & Arroyo Honda Bridges			11-23-17	Day Labor	Borings		[illegible]	302
[illegible]207	V	"	2	F	At Canada del Refugio		.02	1-13-19	Day Labor	Concrete Bridge	23,148	[illegible]	24,777
[illegible]213	V	"	2	F	At Canada del Refugio & Arroyo Honda Bridge			12-28-18	Day Labor	Graveling By-Passes	1,988	18	2,006
[illegible]-208	V	"	2	F	At Canada del Refugio Bridge			4- 2-19	Day Labor	Grading Approaches	3,876	[illegible]	3,961
[illegible]348	V	"	2	F	At Refugio & Arroyo Honda Bridges			12-16-19	Day Labor	15 ft. Concrete Base	26,407	[illegible]	27,367
379	V	"	2	F,G	Canada De Las Llagas	Los Chiqueros Creek	10.82	7-12-22	Southwest Paving Co.	Conc.Shldrs.& 2nd Story A.C.	263,330	[illegible]	[illegible],871
198	V	"	2	G	Elwood	El Capitan Creek	7.70	8- 9-17	Bryan & Brain	15 ft. Concrete Base	80,905	[illegible]	84,945
[illegible]141	V	"	2	G	At Sta. 36+0 near Elwood		.01	6-19-17	Day Labor	15 ft. Concrete Base	150		150
[illegible]151	V	"	2	G	At Ellwood King		0.3	10-29-26	E. Bonelling	Grading & Rock Surf.	20,667	[illegible]	21,269
109	V	"	2	G,I	El Capitan	Stony Creek	16.20	10- 6-14	S.H. Hudson	Grad. & 15' Conc. Base	121,846	[illegible]	127,523
45	V	"	2	H	Rincon Creek	Carpinteria Creek	2.35	11-21-13	Residential Const. Co.	15 ft. Concrete Base	30,180	[illegible]	33,281
[illegible]131	V	"	2	H	Rincon Creek	Carpinteria Creek	2.35	5-25-17	Day Labor	Oil Surfacing	1,392		1,392
[illegible]109	V	"	2	H	Carpinteria	3 Miles S.E.	0.10	11-30-25	Dermanil Const.Co.	A.C.Surf. & P.C.C.Widening	57,506	[illegible]	61,753
[illegible]142	V	"	2	H,J	Carpinteria	Summerland	4.5	9-14-26	Shea Hunter	P.C.Concrete Pave.	288,017	[illegible]	302,843
[illegible]132	V	"	2	I	Stony Creek	Storke Ave Canyon Rd.	.84	5-25-17	Day Labor	Oil Surfacing	849		849
9-16	V	"	2	J	County Road	Serena Station	.69	4-19-14	Day Labor	15 ft. Concrete Base	8,152	[illegible]	9,372
[illegible]133	V	"	2	J	Near Serena		.69	5-25-17	Day Labor	Oil Surfacing	566		566
[illegible]295	V	"	2	J	At Ortega Hill		.04	1-14-20	Day Labor	Guard Rail	135		135
[illegible]297	V	"	2	J	At Easterly City Limits of Santa Barbara		.10	1-15-20	Day Labor	20 ft. Concrete Pave.	2,240		2,240
[illegible]-324	V	"	2	J	Through Summerland		1.00	4- 2-20	Day Labor	1 ft. Concrete Base	24,385	[illegible]	25,162
M-72	V	"	2	J	Ortega Hill	Santa Barbara	1.67	5- 4-25	P.C.C. Const. Co.	P.C.C.Pave. & Widening	87,961	[illegible]	96,463
M 103	V	"	2	J	Summerland	Montecito	1.14	10-13-25	McElroy Co.	Grad. & Rock Surfacing	70,966	[illegible]	75,859
[illegible]701	V	"	2	J	Montecito	Summerland	1.42	8-17-27	Shea Hunter	P.C.Concrete Pave.	61,693	[illegible]	65,804
[illegible]M-5)	V	"	2	K	San Jose Creek	Stony Creek	2.00	8-13-21	J.H. Hudson	20 ft Conc.Pave. 2nd Story	93,226	[illegible]	93,226
M-122	V	"	2	K	Santa Barbara	Goleta	5.11	2- 7-26	Dermanil Const. Co.	P.C.C. Pave. - A.C. Surf.	172,970	[illegible]	182,512
M-153	V	"	2	K	Across San Jose Crk.			5-25-26	McElroy & Feeney	Concrete Girder Bridge	14,875	1,413	16,288
392	V	"	57	A	Cuyama River	Buckhorn Creek	4.09	2- 1-22	Warren Construction Co.	Grading	200,754	10,334	211,088
363	V	(Santa Barbara (San Luis Obispo	57	A)	See Cont. 363-T-SLO-S B-[illegible]-A								
[illegible]-547	V	Santa Barbara	57	A	Cuyama River	Buckhorn Creek	4.09	7-13-23	Day Labor	Rock Surf.	13,213	[illegible]	13,847
	V	" "			Various Locations (SM-VEN-SLO) (PARTS)					Minor Improvements	7,770	[illegible]	7,089
14	IV	Santa Clara	2	A	Palo Alto	Stevens Creek Br.	6.43	10-22-12	City Street Imp. Co.	36 ft. Topsoil on Macadam	103,973	5,619	109,592
15	IV	" "	2	A	Stevens Creek Bridge	Lawrence Sta. Road	6.52	10-22-12	A.T. Gilbert & Son	20 ft Conc. Base - 2in Surf	54,352	[illegible]	[illegible],417
32	IV	" "	2	A	Lawrence Sta. Road	Santa Clara	1.15	5-21-13	Joe Devlin	20 ft. Conc. Base - 2in Surf.	16,744	1,247	17,741

CONTRACT NUMBER	DIV.	COUNTY	RTE.	SEC	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	CONST. ENGR.	TOTAL
88	IV	Santa Clara	2	A	Santa Clara	San Jose	1.93	6-11-14	Ransome-Crummey Co.	24 ft. Topeka on Conc. Base	$ 45,740	$ 6,143	$ 51,883
D-10	IV	" "	2	A	At San Francisquito Creek		.08		Day Labor	15 ft. Bituminous Concrete	2,678	109	2,787
D-157	IV	" "	2	A	San Tomas Aquin Creek	Santa Clara	.49	9-15-17	Day Labor	20 ft. Conc.Base-Topk.Surf.	11,208		11,208
D-178	IV	" "	2	A	Through Mayfield		.93	8-11-21	Day Labor	Concrete Base	28,512	1,674	30,186
23	IV	" "	2	B	Edenvale	Morgan Hill	12.95	3-26-13	Richard Keatinge & Sons	15 ft. Conc.Base-Oil Surf.	111,938	4,484	116,422
28	IV	" "	2	B	San Jose	Edenvale	4.35	4-23-13	Richard Keatinge & Sons	15' & 20' Conc.Base-Oil Surf.	37,085	1,329	38,414
64	IV	" "	2	B	San Jose	Mulia	1.84	4-22-14	John W. McDonald, Jr.	Topeka Surf	15,133	588	15,721
3(74(M-11)	IV	" "	2	B	Perry Station	Morgan Hill	4.33	9-29-21	Hugh J. Crummey	15 ft. Asph. Conc. Surf.	46,281	3,458	49,739
D-21	IV	" "	2	B	At Morgan Hill		.40	11- 5-14	Day Labor	15 ft. Conc. Base	4,774	629	5,403
D-125	IV	" "	2	B	Mulia	1 Mi. N. Coyote	7.38	4- 3-17	Day Labor	Concrete Shoulders	35,336		35,336
D-281	IV	" "	2	B	1 Mi. N. of Coyote	Perry Station	4.17	9-23-19	Day Labor	Topk.Surf. & Conc. Shldrs.	58,258	907	59,165
D-325	IV	" "	2	B	Perry Station	Morgan Hill	4.00	4- 2-20	Canceled 6-8-20	Conc.Shldrs. & Topeka Surf.	1,919	288	2,207
35	IV	" "	2	C	Morgan Hill	Gilroy	7.59	7- 3-13	E.O.Burge	15 ft. Conc. Base-Oil Surf.	57,119	4,301	61,420
72	IV	" "	2	C	Gilroy	Sargent	6.07	6- 9-14	H.L.Peterson & A.J.Grier	15 ft. Concrete Base	78,653	3,318	81,971
320(M-7)	IV	" "	2	C	Gilroy	Carnadero Creek	1.72	9-22-21	R.J.Blanco	20 ft. Conc.Pave. 2nd Story	53,991		53,991
343	IV	" "	2	C	Morgan Hill	Gilroy	7.85	12- 6-21	Clark & Henery Const.Co.	15 ft. Asph. Conc. Surf.	77,697	2,925	80,622
343(M-21)	IV	" "	2	C	Carnadero Creek	Southerly Boundary	4.31	8-10-22	Clark & Henery Const.Co.	15 ft. A.C.Surf. 2nd Story	48,438		48,438
D-17	IV	" "	2	C	Gilroy	Sargent	6.07	4-28-14	Day Labor	Oil Surfacing	7,803	458	8,261
D-18	IV	" "	2	C	At Llagas Creek		.26	12-31-13	Day Labor	15 ft. Conc.Base-Oil Surf.	8,590	1,572	10,162
D-158	IV	" "	2	C	Appr. to Pajaro Riv. Bridge		.07	9-15-17	Day Labor	Asphaltic Concrete	1,390		1,390
D-400	IV	" "	2	C	Morgan Hill	Gilroy	7.86	10- 7-21	Day Labor	2-1/2 ft. Conc. Shldrs.	98,012	1,701	99,713
D-440	IV	" "	2	C	Carnadero Creek	Southerly Boundary	4.35	2-24-22	Day Labor	Concrete Shoulders	44,309		44,309
89	IV	" "	5	A	Northerly Boundary	San Jose	6.79	8-11-14	John W. McDonald, Jr.	18 ft. Concrete Base	68,651	4,722	72,972
D-53	IV	" "	5	A	Northerly Boundary	San Jose	6.79	8- 4-15	Day Labor	Oil Surfacing	5,725	97	5,822
D-156	IV	" "	5	A	At Milpitas		.42	9-15-17	Day Labor	18 ft. Concrete Base	6,596		6,596
M-41	IV	" "	5	A	Milpitas	Coyote Creek	3.72	4- 2-24	Federal Paving Co.	Mac.Shldrs. A.C. Surf.	89,423	5,827	95,250
94EC3	IV	(Santa Clara (Alameda	5	A	See 94EC3 Alameda - Santa Clara 5-C-A								
102	IV	Santa Clara	5	B	Southerly Boundary	Los Gatos	7.59	9-22-14	John A. Marshall	Grading	104,555	10,377	114,932
146	IV	" "	5	B	Los Gatos	San Jose	8.89	7-23-15	Marin Rock Co.	18 ft. Concrete Base	80,897	4,081	84,978
D-78	IV	" "	5	B	Station 562	Station 603	.89	10-11-15	Day Labor	Fencing	43	4	47
D-134	IV	" "	5	B	Stevens Creek Rd.	The Alameda	1.69	5-25-17	Day Labor	Topeka Surface	7,800		7,800
270	IV	Santa Clara) (Santa Cruz)	5	B) A)	Glenwood	Los Gatos	13.56	5-12-20	J. L. Conner	15' & 18' Conc. Base	468,481	27,356	495,837
D-612	IV	Santa Clara	5	B	Near Alma		0.14	5-11-25	Day Labor	Asph. Conc. Pavement	4,891	106	4,997
412	(IV (V	(Santa Clara (San Benito	22	A-B	See Cont. 412 V-IV-S.Bt.-S.Cl.-22-B-A								
426	IV	Santa Clara	32	A	5 Mi. E. of Gilroy	San Felipe	4.52	8-16-23	J.P. Holland	Grading & Rock Surf.	98,490	6,486	104,976
D-568	IV	" "	32	A,B,C	All of Secs. A,B, & C		21.28	12-17-23	Day Labor	Rock Surf. & Stockpiling	20,000		20,000
395	IV	" "	32	B,C	San Felipe	Easterly Boundary	16.76	2-24-22	Rhodes & Price	Grading & Rock Surf.	308,564	39,839	348,403
D-567	IV	" "	32	B,C	Cedar Cr. & N.Fork Pacheco Cr.			1- 9-24	Day Labor	Timber Bridges on Detour	1,552	182	1,734
437	IV	" "	32	B,C	Across Cedar Creek & North Fork Pacheco Cr.			2-20-24	John Simpson Co.	2 Reinf. Conc. Bridges	41,850	3,131	44,981
D-595	IV	" "	32	B,C	Cedar Cr. & Pacheco Cr. Bridges			9- 4-24	Day Labor	Guard Rail	1,261	22	1,283
	IV	" "			Various Locations (TM-226) (M&EER)					Minor Improvements	4,926		4,926
49	IV	Santa Cruz	5	A	Easterly Boundary	Glenwood	5.66	2-26-14	Martin Foss & J.A. Marshall	Grading	85,512	7,341	92,853
83	IV	" "	5	A	Glenwood	Santa Cruz	10.10	7- 7-14	Occidental Const. Co.	Grading	86,772	12,622	99,394
118	IV	" "	5	A	3 Mi. S. of Glenwood	Santa Cruz	6.73	3-13-18	Federal Const. Co.	15' & 17' Concrete Base	86,541	5,284	91,825
343	IV	" "	5	A	Glenwood	Sandhill School	3.16	5-28-19	J.A.Marshall & J.S. Baker	15' & 17' Concrete Base	52,841	4,070	56,911
270	IV	Santa Cruz) (Santa Clara)	9	A,B	See Contract 270-IV Santa Clara) Santa Cruz 5-B & A ")								
M-91	IV	Santa Cruz	44	A	At High Bridge Cr., Fall Cr., & Cleveland Dam Creek			7-13-25	A.J & W.S.Wilson Co.	R.C. Bridge & Culverts	14,490	1,110	15,600
D-Unit	IV	" "	44	A	Boulder Creek	Redwood Park		10- 9-24	Day Labor	Widening Grade	9,300		9,300

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

					FROM	TO	LENGTH MILES	COMPLETION DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	MAINT.	TOTAL
				A	Bowlder Creek	Station 1284+00	0.08	7- 7-27	Day Labor	Grading	$ 15,712	$	$ 15,712
				A	Bowlder Creek	Distr. Redwood Park		1- 1-28	Day Labor	Grading & Corr Metal Pipe Culv.	29,505		29,505
				A	Bowlder Creek	Distr. Redwood Park		6- 8-28	Public Roads	(2-12ft. Box Culverts and) (1-12ft. Corner Bridge)	14,570	1,582	16,152
				A	Bowlder Creek	Distr. Redwood Park	8.11	1-31-28	Day Labor	Rock Surfacing	10,860		10,860
				A	At Entrance at Creek		.11	8-30-27	Standley Bros.	Concrete Bridge	80,777	3,313	84,110
				A	Shellburg Boundary	Redding	16.57	6- 1-27	Warren J. Kinnear	18 ft. Conc. Base	456,430	49,081	505,511
				A	At Anderson & Stanton Dtr. & Irrigat. Ditch		.05	10- 1-27	Pacific Bridge & Construction Co.	Concrete Bridge	27,484	1,863	29,347
				A	At Shellburg Dr Br.			11- 6-27	Day Labor	Bridge Approaches	2,184	57	2,241
				A	Anderson Irrigation District			12- 6-27	Day Labor	Guarding System	1,336		1,336
				A	Shellburg Boundary	Redding	15.57	4-30-28	Day Labor	Filling Const. Joints	625	12	637
				A	At Stanton Dr. & Anderson Ditch			4-30-28	Day Labor	Approach Fills	281		281
				A	Redding & Shellburg	Redding		4-30-28	Day Labor	Guard Rail, Culv. & Br. Pave.	6,948	564	7,512
				A	Redding & Anderson Dr.	Redding		4-30-28	Day Labor	Slope Paving	1,371	147	1,518
				A	Anderson Dr. & Bowlder Undercrossings			11- 1-27	Day Labor	Const. & Pave. Undercrossing	52,698	4,077	56,775
				A	Redding Undercrossing			4-30-28	Day Labor	Tile Drain, Guard Rail & Culv.	1,821	17	1,838
				A	Redding Dr. Crossing Dtr., Anderson Ditch & Cottonwood Dr.			7- 1-27	Day Labor	Pav. Appr. & Widen Pavement	2,406	202	2,608
				A	At Locust Dr., Clover Dr. & Stanton Ditch			4-30-28	J. A. Moore & Son, Inc.	Painting Bridges			1,001
					At Fifth Ditch		.07	7- 1-27	Reese Construction Co.	Concrete Bridge	36,975	1,426	38,401
					Redding	Bowlds	10.83	7-31-27	Fowler & Mcintyre	Grading	70,003	11,198	81,201
					At Bellbrae, Bowlder, Salt Mountain, Bowling & Stanton Drs.		.09	7- 9-27	deWeese Bros	Concrete Bridges	34,583	3,414	37,997
					Anderson & Salt Mountain Dr. & Redding		.09	6-30-27	Day Labor	Grading	3,086	183	3,269
					W. Redding	Bowlds	6.92	10- 1-27	Kinnear Paving Co.	20 ft. Conc. Pave	453,755	19,431	473,186
					Bowlds	Sacramento River	14.31	7-31-27	Fowler & McIntyre	Grading	232,562	24,524	257,086
					Bowlds	Halfway Creek	6.92	1- 5-28	Newman Construction Co.	Grad. & Rock Surfacing	552,935	45,878	598,813
					At Salt Dr. & Sac. River		.13	7-30-27	Reese Constr. Co.	Concrete Bridges	40,013	1,123	41,136
					Sacramento River	Co Limits	13.31	6- 1-27	J.F. Fitzpatrick	Grading	205,563	21,004	226,567
					At Bowlds & Downey Crossings			6- 1-27	Day Labor	Reinforced Concrete Bridges	14,203	59	14,262
					Bowlds	Sacramento River	11.70	10- 1-27	Day Labor	Widening	9,528		9,528
					Halfway Tanks	Dry Creek	11.84	1- 5-28	Newman Construction Co.	Grad. & Rock Surfacing	453,472	44,195	497,667
					Anderson Salt Grade			4-30-28	Olin Lumbrige	Reinf. Conc. Timber Bridge	16,957	2,206	19,163
					Anderson Downey Tanks			7- 1-27	Hamilton & Cunningham	Reinf. Conc. Arch Bridge	61,308	1,560	62,868
					Anderson Downey Tanks & Mt. Shasta Ammier			5-31-27	Hamilton & Cunningham	Concrete Arch Bridge	88,805	1,760	90,565
					Salt Tanks	Co Limits	4.42	7- 1-27	Sharpe Brothers Inc.	Grading & Rock Surf.	297,513	20,361	317,874
					Anderson Cr. Tanks			7-31-27	Reese Constr. & C.E. Brugger	Reinf. Concrete Bridge	114,985	4,153	119,138
					Anderson Slough Creek			6-30-27	Fred J. Maurer & Son, Inc.	Reinf. Concrete Bridge	22,524	1,663	24,187
					Salt	County Boundary	10.0	10- 1-27	Day Labor	Rock Surfacing	26,287	380	26,667
					Co Limits	Round Creek	8.92	6- 1-27	F. Maxwell	Grading	99,687	11,244	110,931
					At Anderson & Stanton Creeks		.13	6-30-27	F. Maxwell	Concrete Bridges	9,108	672	9,780
					Round Tanks	1 Butterfly Boundary	11.28	6- 1-27	Consumnes-Green & Co.	Grading	178,715	18,159	196,874
					At Seattle, Mosaic & Filger Creeks		.04	6-16-27	May & Soulé	Concrete Bridges	18,867	1,033	19,900
					At Bowlbrae & Shotgun Dr. Bridges			11- 1-27	Day Labor	Grading Appurtenances	360	14	374
					Co Limits	Shotgun Creek	6.67	6- 1-27	A. Harrison Co.	Grading & Rock Surfacing	259,240	19,521	278,761
					Anderson Cottonwood Ditch			11- 1-27	E.B. Stevens	Reinf. Concrete Bridge	58,945	2,920	61,865
					Anderson Shotgun Tanks			11-15-27	E.B. Stevens	4 Span 4 Channel Steel Br.	16,281	1,424	17,705
				A	Westside Boundary	Upper House	3.6	11- 9-27	Prisoner Labor	Grading	218,541	6,860	225,433
				A,B	Upper House	Redding	17.54	4-14-28	F. Maxwell	Grading	209,122	19,041	228,163
				A,B	Upper House	Redding	17.54	11- 1-27	Day Labor	Rock Surfacing	43,029	1,690	44,719
				A,B	At Boundary & Salt Creeks & Adm. Bldg.			4-30-28	Day Labor	Grading Appurtenances	813	65	878
				A,B	Upper House	Redding	17.54	4-30-28	Day Labor	Rock Surf. & Minor Features	20,864	1	20,865

CONTRACT NUMBER	DIV.	COUNTY	RTE.	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONST'N. COST	EXCESS	TOTAL
D-355	II	Shasta	28	A,B,C	2.3 Mi. S.W. of Ignot	Burney	17.72	2-26-31	Prison Labor	Grading	$ 510,098	$13,604	$523,702
447	II	"			At Redding			7-11-24	J.P.Brennan	Div. Office Bldg			20,214
D-606	II	"			At Redding			12-11-24	Day Labor	Sidewalks & Lawn	1,707	96	1,803
	II	"			Various Locations (DM-166-167-168-169-178-219) (92EE12-13-16) (91EE1)					Minor Improvements	28,377	24	28,401
D-116	III	Sierra	25	A	Westerly Boundary	Downieville	17.33	1-29-17	Prison Labor	Grading	298,002	4,134	302,136
								9-23-19	Day Labor	Steel Bridge	17,709	59	17,768
D-261	III	"		A	Across North Fork Yuba River								
D-157	III	"		A	Westerly Boundary	Goodyears Bar	7.82	4-25-22	Day Labor-No Work Done	Rock Surfacing			
474	III	(Sierra	36	A)	See Cont. 474 Nev-Sie-36-B-A.								
		(Nevada		B)									
100	II	Siskiyou	3	A	Weed	Dunsmuir	16.60	9-22-14	Toohey & Johnson	Grading	94,761	9,344	104,105
								1- 9-24	Day Labor	Guard Rail	897		897
D-566	II	"	3	A	Black Butte Overhead Crossing								
M-166	II	"	3	A	Near Weed		.22	3-28-27	J.P.Brennan	Grading & Rock Surf.	8,562	258	8,820
180	II	"	3	A	At Greenhorn, Yreka & Little Castle Creeks		.04	5-22-17	John H. May	Concrete Bridges	10,013	794	10,807
173	II	"	3	A,B	Upton	Shasta River	10.74	6-22-22	Kaiser Paving Co.	18 ft. Concrete Pave.	311,824	11,007	322,831
D-264	II	"	3	A,B	Shasta River	Southerly Boundary	22.70	7-26-22	Day Labor	Maintaining Detour	2,486		2,486
M-164	II	"	3	A,B	Dunsmuir	Shasta River		3- 9-27	J.P. Brennan	Clearing & Grubbing	4,676	8	4,684
315	II	"	3	B	At Parks & Willow Creeks & Shasta River		.02	7-30-21	T.H.Polk	Concrete Bridges	24,095	1,419	25,514
415	II	"	3	B	Gazelle	Yreka	17.61	12-27-22	V.R. Dennis Constr.Co.	Grad. & Rock Surfacing	220,130	15,446	236,076
D-169	II	"	3	B	At Yreka & Greenhorn Ck. Bridges			10-22-17	Day Labor	Grading Approaches	2,183	57	2,240
D-232	II	"	3	B	Weed	Gazelle	10.84	5- 8-19	Day Labor	Grading	186,164	10,208	196,372
66	II	"	3	C	Hornbrook	Oregon Line	8.03	5-27-14	Mason & Fradenburgh	Grading	44,195	2,770	52,965
118	II	"	3	[illegible]	Hornbrook	Yreka	16.92	12-22-14	E.T. Johnson	Grading	146,699	23,439	170,138
D-99	II	"	3	[illegible]	Yreka	Oregon Line	.25	3-16-16	Day Labor	Grading	3,129	55	3,184
D-182	II	"	3	[illegible]	Oregon Line	4-1/2 Mi. South	4.50	8- 2-17	Day Labor	Rock Surfacing	42,132	500	42,632
M-32	II		3	[illegible]	Hornbrook	Yreka	6.13	11- 9-23	(Calvert & Calvert) (Schroeder & Pearce)	Guard Rail	25,289	530	25,819
M-33	II	"	3	C	1/4 Mi. N. Shasta Riv.	Oregon Line	14.30	11- 9-23	Dunn & Baker	Grad. & Rock Surfacing	355,369	29,873	385,242
D-159	II	"	3	C	Dugsett Creek	Rto. 3 at Shasta R.	20.7	5- 3-22	Prison Labor	Grading	499,939	29,316	529,255
	II	"			Various Locations (DM-113-170-171-172 - 20?) (92EE2-3-4-5)					Minor Improvements	18,817	12	18,829
79	X	Solano	7	A	Benicia	2-1/2 Mi.S.of Cordelia	9.05	6- 9-14	Coomary, Peterson Co. Inc.	15 ft. Concrete Base	95,013	7,922	102,935
D-271	X	"	7	A	Benicia	2-1/2 Mi.S.of Cordelia	9.05	10-15-19	Cancelled 6-8-20	Asph. Surface			
114	X	"	7	B	2-1/2 Mi.S. of Cordelia	Fairfield	8.13	11-20-14	P.H. Hoare	15 ft. Concrete Base	71,668	3,951	75,619
D-60	X	"	7	B	2-1/2 Mi.S.of Cordelia	Fairfield	8.06		Day Labor	Oil Surfacing	4,050	149	4,199
D-126	X	"	7	B	At Suisun Creek & Sta. 790		.07	5- 2-17	Day Labor	15 ft. Con.Base-Con.Bridge	6,622	454	7,076
M-54	X	"	7	B	Rockville	Fairfield	3.96	6-19-24	Tibbals, Percival & Cress	Grav. & Conc. Shldrs.	48,303	2,663	50,966
74	X	"	7	C	Fairfield	Vacaville	8.83	6- 9-14	Coomary, Peterson Co. Inc.	15 ft. Conc. Base-Oil Surf.	98,450	5,319	103,769
149	X	"	7	C	Fairfield	Vacaville	8.85	5-19-22	California Const.Co.	15 ft. Asph. Surf.	93,413	3,518	96,931
D-418	X	"	7	C	Fairfield	Vacaville	8.85	3- 8-22	Day Labor	Concrete Shoulders	80,859	566	81,425
111	X	"	7	C	Vacaville	Batavia	8.24	11-10-14	P.L. Burr	15 ft. Concrete Base	84,253	5,582	89,835
D-270	X	"	7	C	Vacaville	Near Batavia	8.17	10-15-19	Cancelled 6-8-20	Asph. Surface	233		233
M-48	X	"	7	D	Vacaville	Batavia	8.29	5-21-24	Force & Corrigan	20 ft. Asph.Conc.Pave.	251,018	7,581	258,599
186	X	"	7	E	Batavia	Putah Creek	8.35	6- 6-17	T.W. Olney	15 ft. Concrete Base	88,511	6,195	94,706
M-49(M-151)	X	"	7	E	Batavia	Northerly Boundary	8.35	11-17-21	Clark & Henery Const.Co.	15 ft. Asph. Surf.	157,729		157,729
D.M-50	X	(Solano	7	E	See D.M-50 Yol-Sol-7-A,E								
		(Yolo		A									

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

193			d	A				5-22-17			15 ft. Concrete Base	$ 54,898	$ 6,227
312			8			Co	1.41	12-27-19			Guard Rail	1,478	225
480			53	A		2 Mi. E. of	.72	7-13-2			Experimental Pave.	75,695	7,113
505			53	A			1.93	9-22-2			Grading	33,170	1,220
289			53			Rio Vista	11.87	5-10-21			15 ft. Concrete Base	369,697	16,649
416			53	B	Over S.F.-	R.R. Near		1- 4-21			Conc. Bridge & Approaches	17,128	2,711
411			53			Rio Vista	1.00	11-17-21			Exp. Sub-grade Treatment	6,394	146
652			53			Rio Vista	1.00	10- 8-23			Rock Shoulders	3,239	
				A	Various Locations (EM-106)						Minor Improvements	4,999	10
68	IV		1	A	Northerly Boundary		4.29	5-27-14			Grading	55,733	7,892
314	IV		1	A	Cloverdale		Healdsburg	15.97	7-30-21		Henry J. Kaiser	488,413	24,483
408	IV		1	A	Over N.W.Pac.	R.R. near	Lytton		12-14-20		C.H. Gildersleeve	11,535	967
423	IV		1	A	Near Lytton			.32	7-10-23		Thomsen Bros.	10,050	1,058
409	IV		1	A	Cloverdale		Cotati	5.90	11- 8-21		Ole, Lewis-Cancelled	1,087	135
510	IV		1	A	Through Cloverdale			1.33	7-14-26		J.V. Galbraith	52,457	2,711
16	IV		1	B	Healdsburg		Smith Road	11.45	10-22-12		Barnard Keatinge & Sons	15 ft. Conc. Bvem-Bit Surf.	198,079
D-22	IV		1	B	3 Mi.S. of Healdsburg			.04	10-20-14		Day Labor	Rock Surfacing	116
D-57	IV		1	B	Sta. 1304+.7		Sonoma Line	.25	8- 6-19		Day Labor	15 ft. Concrete Base	12,970
D-88	IV		1	B	Healdsburg		Russian River	.58	12-17-15		Day Labor	15 ft. Concrete Base	14,490
406	IV		1	B	At Russian River Bridge				11- 2-21		Day Labor	Bridge Approaches	6,194
586	IV		1	B	At Russian River Overflow Channel				9-11-24		Day Labor	Approach Fills to Bridge	1,565
M-90	IV		1	B	Healdsburg		Smith Road	14.16	6-17-22		Baldassini & Jones	Portland Cement Conc.Pave	566,306
129	IV		1		Willow Brook		Southerly Boundary	4.45	4-30-13		Texas Bros.Co.	15 ft. Concrete Base	73,731
177	IV		1		Highland Ave		Willow Brook	3.60	10-11-14		W.C. Price & Co.	Grading	21,794
206	IV		1		Santa Rosa		Willow Brook	10.42	10-17-17		Municipal Imp. Co	15 ft. Concrete Base	238,434
19)	IV		1		Willow Brook		1 Mi.S. of Petaluma	4.29	6- 6-2		A.G. Rausch	15 ft. Asph. Conc. Surf	50,198
367	IV		1		At Petaluma-S	R.R.	Crossing		5- 5-21		Day Labor	Automatic Flag Mast	686
435	IV		1		Willow Brook		1 Mi.S. of Petaluma	4.29	2-24-27		Day Labor	Concrete Shoulders	41,183
102	IV		1		Across Willow Brook				10- 9-29		Lozier & Carr	Reinf.Conc.Girder Bridge	17,718
158	IV		8	A	Reclamation		Fairville	7.05	11-25-15		Baker,Borland & Ayer	Grading	52,226
112	IV		2	A	Station		Sonoma Creek	1.25	9- 9-15		Day Labor	Rock Surfacing	7,017
123	IV		2	A	Near Petaluma Creek				4- 4-17		Day Labor	Grading	932
163	IV		2	A	See Contract No. [illegible]								
317	IV		2	A	See Contract No. [illegible]								
382	IV		8	A	See D-[illegible]								
M-46	IV		2	A	See M-46								
323	IV		2	A,B	Fairville		Easterly Boundary	9.28	9-24-21		Healy-Tibbitts Const.Co.	Grading & Rock Surfacing	
D-62	IV		2	A,B	Sonoma Creek		Eastern Boundary	5.32	8-24-15		Day Labor	Grading	
516	IV		2	A,B					11- 5-22		Day Labor	2944' Guard Rail	
M-162	IV		8	A,B	Across Sonoma Creek				5- 4-27		Prentice & Cleghorn	Steel & R.C. Bridge	
486	IV		2	A,B	At Sonoma Cr.	Bridge		5.7	5- 6-28		Sonoma Bridge	Grading & Rock Surf.	
420	IV		2	B	Across Sonoma Cr.				11-21-23		Simpson & Nicolasen	Rein Conc. Bridge	
M-121	IV		2	B	Woodbury Jct.		Sear Ch. Line	1.1	11- 5-26		B & H Gomez	Grading & Bit Mac.Surf	
329	IV		2	A	Santa Rosa		Petaluma	11.73	5-22		Ernest Brown & Co	18 ft. R.C. Macadam	
397	IV		2	A	Santa Rosa		Petaluma		10- 3-24		Day Labor	Oiling & Screenings	
433	IV		2	B	Petaluma		Sonoma Line	11.50	1- 9-24		Silvernale & Jones	Grad.Rock Surf.Conc.Pave.	
	IV				Various Locations (EM-106)							Minor Improvements	
5	X		2	A	Southern Boundary		Petaluma	10.04	7-12		E.F. Burge	15 ft.Conc. Base-Bit Surf.	
M-49	X		2	A	Southern Boundary		Petaluma	4.04	8-21		C.A. Costello,Jr	15 ft. Asph. Conc Surface	
128	X		2	A	At Turlock City Limits				10-18		Day Labor	Asphalt Concrete	

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

CONTRACT NUMBER	DIST.	COUNTY	ROUTE	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	CONST. ENGR.	TOTAL
D-333	X	Stanislaus	4	A	Southerly Boundary	Turlock	2.30	2-15-21	Day Labor	Conc.Shldrs.& Asph.Conc.Surf.	$ 17,122	$ 1,116	$ 18,238
D-238	X	"	4	A	North of Turlock	Sta. 173+44 to 178+92	0.17	3- 5-27	A.Teichert & Son Inc.	Asph. Concrete Pave.	7,246	430	7,676
911(3)14	X	"	4	A	North of Denair		0.2	2-21-28	Standard Paving Co.	Grading & Asph.Conc.Pave.	6,360	1,232	7,592
911(2)14	X	"	4	A,B	Turlock	Northerly Boundary		12-30-27	Lee J. Immel	Six Reinf. Conc. Bridges	19,490	1,863	21,353
25	X	"	4	B	Ceres	Northerly Boundary	9.61	3-31-13	Considine & Bates Co.	15 ft. Conc. Base-Oil Surf.	70,450	7,551	78,001
329(M-12)	X	"	4	B	1.2 Mi.N. of Ceres	Tuolumne River Bridge	1.89	10- 5-21	Standard Paving Co.	15 ft. Asph. Conc. Surface.	33,305		33,305
D-1209	X	"	4	B	At Tuolumne River Bridge		.02	3-21-17	Day Labor	15 ft. Concrete Base	461		461
M-119	X	"	4	B	Modesto	Stanislaus River	7.77	4-23-26	Valley Pav. & Const. Co.	(P.C.C.Widen.& Asph.Conc.Surf.	261,364	11,103	273,467
222	X	"	13	A	At Riverbank		.69	4-10-18	Alfred H. Vogt	Bridge-12 ft. Conc. Base	24,596	1,155	25,751
D- 50	X	"	13	A	Salida	Oakdale	13.81		Day Labor	12 ft. Concrete Base	102,599	5,238	107,817
D-236	X	"	13	A	Bald Eagle Ranch	Oakdale	9.26	11- 6-18	Day Labor	Concrete Shoulders	66,891	5,795	72,686
252	X	"	13	B	Oakdale	Easterly Boundary	12.79	4- 3-19	Palmer & McBryde	15 ft. Concrete Base	256,799	11,161	267,960
D- 29	X	"	13	B	Knights Ferry Road	Easterly Boundary	1.32	10-30-14	Day Labor	Grading	6,594	139	6,733
121	III	Sutter	3	A	Yuba City	Northerly Boundary	11.70	1-12-15	Forrest City Pave.& Con.Co.	15 ft. Concrete Base	96,144	5,438	101,582
273	III	"	15	B	1 Mi. S. Sutter City	Yuba City	6.67	11- 3-20	John Doyle	15 ft. Concrete Base	173,776	7,222	180,998
393	III	Sutter-Colusa	15	A,B	See Cont. 393-III Colusa-Sutter 15-B,A								
260	II	Tehama	3	A	Southerly Boundary	Los Molinos	11.72	11- 6-19	Lynn S. Atkinson,Jr.	15 ft. Concrete Base	329,609	18,958	348,567
D-235	II	"	3	A	At Townes & Thomplin Creeks			6-11-19	Day Labor	Grading Bridge Approaches	1,920	132	2,052
D-430	II	"	3	A	Southerly Boundary	Los Molinos		2-24-22	Day Labor	Paving Bridge Approaches	7,219	20	7,239
D-444	II	"	3	A	Southerly Boundary	Los Molinos	5.00	3-22-22	Day Labor	Filling Const. Joints	275		275
D-448	II	"	3	A	Southerly Boundary	Los Molinos		4- 5-22	Day Labor	Guard Rail	357		357
136	II	"	3	B	Proberta	Red Bluff	6.38	6- 1-15	Hoffman & McLaren	15 ft. Concrete Base	57,333	4,633	61,966
272	II	"	3	B	1.0 Mi.S. of Red Bluff			9- 8-20	P.L. Burr	Undergrade Crossing	23,124	1,256	24,380
D-252	II	"	3	B	At Rodeo, Elder, Jackson & Oat Creek Bridges			9-23-19	Day Labor	Pav. Br. Appre.& Ret. Walls	5,939	576	6,515
D-348	II	"	3	B	At Red Bank Creek			10- 6-20	Day Labor	Back Filling & Paving	2,256		2,256
D-449	II	"	3	B	Tehama Junction	Red Bluff		4- 5-22	Day Labor	Guard Rail	492		492
D-527	II	"	3	B	Red Bluff Undercrossing			12-27-22	Day Labor	Widen. Pavement	233		233
508	II	"	3	B	Antonia Reade Dr.	At Red Bluff		7-14-26	Heldener Const. Co.	Reinf. Concrete Bridge	32,141	1,560	33,701
142	II	"	3	C	Red Bluff	Northerly Boundary	12.74	7-20-15	James Fitzpatrick	Grading	51,179	2,231	53,410
277	II	"	3	C	Red Bluff	Northerly Boundary	13.60	3- 3-21	Henry J. Kaiser	15 ft. Concrete Base	304,827	5,419	310,246
D-320	II	"	3	C	End of L.O. #173	Northerly Boundary	.41	3-23-20	Day Labor	Grading	5,115	400	5,515
D-356	II	"	3	C	Red Bluff	Northerly Boundary	13.60	3-22-21	Day Labor	Grading Line Changes	12,718	1,617	14,335
D-446	II	"	3	C	Red Bluff	Northerly Boundary	13.60	4-22-22	Day Labor	Filling Const. Joints	523		523
D-450	II	"	3	C	Red Bluff	Northerly Boundary		4- 5-22	Day Labor	Guard Rail	2,168	45	2,213
D-528	II	"	3	C	Brewery Creek Bridge			12-27-22	Day Labor	Paving Approaches	599		599
271	II	"	3	D	Los Molinos	Red Bluff	14.52	6-24-20	Lynn S. Atkinson, Jr.	15 ft. Concrete Base	443,643	34,031	477,674
D-425	II	"	3	D	Los Molinos	Red Bluff		1-18-22	Day Labor	Driveways to Adj. Property	1,827	57	1,884
D-445	II	"	3	D	Los Molinos	Red Bluff	14.52	3-22-22	Day Labor	Filling Const. Joints	701	2	703
D-451	II	"	3	D	Los Molinos	Tehama Junction		4- 5-22	Day Labor	Guard Rail	209		209
434	II	"	3	D	Red Bluff	Los Molinos		1-10-24	McKenzie & Pollard	6 Reinf. Conc. Bridges	48,977	4,077	53,054
M-146	II	"	3	E	At Sacramento R. Br.			9-14-26	D.E. Burgess	Repairs & Painting Br.	7,184	1	7,185
162	II	"	3,7	B,A	Corning	Proberta	9.75	1-11-16	Taylor & Berliner	15 ft. Concrete Base	80,147	7,570	87,717
76	II	"	7	A	Southerly Boundary	Corning	8.81	6- 9-14	Burns, Jacinto & DaRoza	15 ft. Concrete Base	76,574	5,428	82,002
81	II	"	7	A	Southerly Boundary	Corning	3.23	10-25-15	Day Labor	Oil Surfacing	2,091	502	2,593
351	II	"	7	A	At McClure & Truckee Creek Bridges			9-23-19	Day Labor	Paving & Retaining Walls	4,351	131	4,482
D-351	II	"	7	A	At Thomes Creek Bridge			12- 8-20	Day Labor	Grading Approaches	13,429	908	14,337
D-452	II	"	7	A	Tehama Junction	Southerly Boundary		4- 5-22	Day Labor	Guard Rail	1,066		1,066
472	II	"	7	A	Through Corning		1.00	6-17-25	E.A. Burns	P.C. Conc. Pavement	36,048	4,453	40,501
M-166	II	"	28	A	At Paynes Creek			3-22-27	Martin Const. Co.	Maintenance Bldgs.	2,671	2	2,673
28E801	II	"	29	A	½ Miles E Red Bluff	1½ Miles E. Red Bluff(Portions)		12-12-27	E.B. Bishop	Rock Surfacing	4,878	45	4,923

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

		Mohawk	39	A-F	See [illegible]					$	$	$
		Quincy										
		Johnsonville			Various Locations [illegible]		[illegible]	1-18)				
111		Greenville	20	A,B	2 Mi E Honeyville	Two Lane Oiled	1.11	1-14-21	Thompson & Shaw	Grading	174,270	24,225	221,496
[illegible]			20	A	Honeyville	Two Lane Oiled	1.61	1- 5-21	Dw Labor	Rock Surfacing	3,494		3,494
			20	A	Honeyville	Two Lane Oiled		1-13-22	Dw Labor	Rock Surfacing	694		694
			20	A,B	2 Mi E of Honeyville	Two Lane Oiled		1- 9-23	No Bids Rec				
			20	A	Honeyville	1 Mi. S. Keystone	4.14	4-11-20	Dw Labor	Grading & Surfacing	47,582	1,735	49,317
			20	A	Two Lane Oiled	Fresno Western Drive	4.14	1-27-22	Artisan Labor	Grading	114,172	12,853	119,025
			20	A	Big Bend, Big Fresno, [illegible]	Dam		4-31-22	Dw Labor	Concrete Bridges	36,770	405	37,175
[illegible]			20	B	Trinity River Bridge			4-31-22	Dw Labor	Conc. Piers	3,390	46	3,436
191	II		20	B	Burnt Ranch	Hayfork Two Trees	1.71	3-25-21	Artisan Labor	Grading	547,364	29,771	577,135
					Helena	[illegible]	1.63						
242	II		20	A	White Oak Creek	Helena	11.40	5-28-19	F. Reinmuth	Grading	242,596	23,855	306,451
370	II		20	B	At Mogowith Creek			5-25-21	Dw Labor	Concrete Bridge	8,565	187	8,843
					[illegible]						14,524		14,524
65	VI	Fresno	4	A	Englehart	Fresno	1.87	4- 6-17	Geo. S. Bowers & Sons	15 ft. Concrete Base	63,698	1,573	65,271
70	VI	"	4	A	Southerly Boundary	Selma	4.03	4- 6-17	The M.R. Co., Inc.	15 ft. Concrete Base	71,076	2,246	74,322
205	VI	"	4	A,B	Fowler	Fowler	4.36	4- 2-17	Dwight G. Garner	15 ft. Concrete Base	74,132	2,357	76,489
76	VI	"	4	B	Tipton	Tulare	5.18	4- 2-17	T.E. Sutter	15 ft. Concrete Base	108,827	6,888	115,715
195	VI	"	4	B	Through Tipton		1.47	11-15-22	Valley Grav. & Const.Co.	A.C. Surf.	7,851	190	8,041
[illegible]	VI	"	4	B	Through Tipton		1.45	4- 8-22	Dw Labor	Concrete Shoulders	5,267	428	5,695
189	VI	"	4	B	1/2 Mi.W. Visalia	Visalia	3.16	4- 6-17	J.E. Sutter	15 ft. Concrete Base	138,326	6,828	145,165
193	VI	"	4,5	B	Goshen	Visalia	6.42	4-13-15	Wilson & Hamill	15 ft. Concrete Base	61,998	4,044	66,032
282	VI	"	4,5	B	Visalia	Oak Grove School	1.21	4-10-21	J.E. Sutter	15 ft. Asphalt Conc. Surf	27,268	2,758	30,026
195	VI	"	4,5	B,D	Visalia	Oak Grove School	1.21	11-15-19	Dw Labor	Conc. Shldrs.	20,759	21	20,780
195	VI	"	4	E	Traver	Easterly Boundary	4.20	4-16-15	W.A. Kentfield & Sons	15 ft. Concrete Base	63,312	2,321	65,633
186	VI	"	4	E	Goshen	Traver	6.47	4-16-15	W.A. Kentfield & Sons	15 ft. Concrete Base	69,545	3,514	73,059
48	VI	"	4	E	Traver	Easterly Boundary	4.35	1- 7-16	Dw Labor-Discontinued	Oil Surface	1,391	73	1,464
95	VI	"	4	E	Goshen	Traver	5.39	1- 7-16	Dw Labor-Discontinued	Oil Surface	11		11
132	VI	"	4	E	At Kings River Bridge		.25	6-26-17	Dw Labor	15 ft. Concrete Base	1,840	5	1,845
[illegible]	VI	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
148	VI	Tulare	11	A	Easterly Boundary	Near Goshen	1.04	8-10-15	White & Cornell	15 ft. Concrete Base	29,443	2,158	31,601
503	VI	"	11	A	Easterly Boundary	Southern Pacific Ry.	3.04	3-26-20	Dw Labor	Oil Surface	4,122	2	4,124
367	VI	"	11	F	Three Rivers	Sequoia Nat'l Park	6.85	5-24-22	Nevada Contracting Co.	Grad. & Rock Surfacing	146,638	12,855	158,493
532	VI	"	11	F	Three Rivers	Sequoia Nat'l Park	6.91	1- 4-23	Canceled	Rock Surfacing			
	VI	"	11	F	Various Locations (Tahiti - Ash Mt)					Minor Improvements	14,591	31	14,622
332	V	Tulare	13	A	Easterly Boundary	1 Mi.N. Keystone	3.40	10-19-21	K.Kulf Const.Co. Inc.	15 ft. Concrete Base	209,468	6,917	216,385
6	V	"	13	A	Westerly Boundary	Keystone	10.84		Dw Labor	Grading	71,079	2,687	73,766
353	V	"	13	A	Westerly Boundary	1 Mi. E. Keystone		9-11-19	Dw Labor	Stockpiling Conc. Aggregate	39,757	1,200	40,957
33	V	"	13	B	Keystone	Sonora	11.01	4-26-15	Dw Labor	Grading	45,376	2,640	48,016
188	V	"	13	B	Jamestown	Sonora	3.52	4- 7-21	Dw Labor	15 ft. Concrete Base	106,694	4,827	111,521
193	V	"	50	B	[illegible] Creek At	Prioeta	4.0	1-24-27	Dw Labor	Grading	15,000		15,000
	V	"			Various Locations (34-91-90-118-1[illegible]-271-282-285)(31[illegible]-7)						55,317	10	55,327
31	VII	Ventura	2	A	Southerly Boundary	Newbury Park	7.34	5-21-13	Leigh G. Garnsey	15 ft. Concrete Base	75,164	4,126	79,290
13	VII	"	2	A	Southerly Boundary	Newbury Park	7.34	6-13-14	Dw Labor	Oil Surf. & Shoulders	16,725	552	17,277
34	VII	"	2	A,B	Fermoy Easterly Bdry.	Conejo Trade	4.20	11- 6-19	Geo. R. Curtis	18' & 20' Conc. Pavement	189,675	5,537	195,213
40	VII	"	2	A,B	Southerly Boundary	Chanslorville	14.50	3-19-24	Sam Hunter	20 ft. Conc. Pavement	155,578	10,981	166,559
81	VII	"	2	B	Newbury Park	Springville	11.16	7- 7-14	Leigh G. Garnsey	16 ft. Conc. Base-Oil Surf.	151,331	8,440	159,771
[illegible]-21	VII	"	2	B	At Arroyo Calleguas		.01	7-26-16	Munoz & Munoz	Concrete Bridge	4,514	678	5,192

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

CONTRACT NUMBER	DIV.	COUNTY	RTE.	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	CONSTRUCTION COST	CONST. ENGR.	TOTAL
D-171	VII	Ventura	2	B	At Arroyo Calleguas Bridge		.02	11-17-17	Day Labor	Channel Protection	$ 3,629	$ 10	$ 3,639
M-106	VII	"	2	B,C	Camarillo	Ventura	13.19	11-13-25	H.H. Peterson	P.C.C. Pavement & Widening	390,093	13,308	403,401
M-155	VII	Ventura Los Angeles	2	B,C	See M-155 Los Angeles-Ventura-2-C,B.								
171	VII	Ventura	2	C	Springville	Santa Clara River	5.63	7-10-16	Modern Constr. Co.	15 ft. Concrete Base	46,407	2,931	49,338
188	VII	"	2	C	Santa Clara River	Ventura	4.16	6- 6-17	Conner Cont. Co.	15 ft. Concrete Base	43,029	3,041	46,070
M- 79	VII	"	2	D	At Ventura River Bridge			5-20-26	Otto Parlier	Extension to Present Bridge	28,951	1,330	30,281
52	VII	"	2	D,E	Ventura	Sea Cliff	8.02	8-26-14	Carl Leonardt	15 ft. Concrete Base	135,842	4,498	139,740
D- 34	VII	"	2	D,E	Ventura	Sea Cliff	8.02	3-23-15	Dry Labor	Oil Surfacing	5,913	771	6,684
M-151	VII	"	2	DEFG	Ventura	Benham Subway	13.04	10-12-26	J.F. Knapp	P.C.C.Pave. & Sea Wall	701,545	30,928	732,473
97FFC1	VII	"	2	E	Near Sea Cliff			9-16-27	Hall Bros.	Reinf.Conc. Retaining Wall	9,763	595	10,358
M-104	VII	"	2	F	At Mobile Causeway		0.10	10-23-25	Edward W. Dahl	Grad. & Rock Surfacing	13,248	644	13,892
DM-116	VII	"	2	F	At Rincon Sea Wall		1.2	3-27-26	Day Labor	Removing old Trestle, Const. Temp approaches. & Rock Surfacing	37,794	1	37,795
73	VII	"	2	F,G	Benham	Westerly Boundary	3.70	6- 9-14	Modern Const Co.	15 ft. Concrete Base	71,091	3,468	74,559
D- 43	VII	"	2	F,G	Benham	Westerly Boundary	5.05	5-14-15	Day Labor	Oil Surfacing	2,991	572	3,563
M- 53	VII	"	2	F,G	Sea Cliff	Rancho El Rincon	1.20	6-11-24	J.H. Tillman Co.	Grading & Sea Wall	400,135	16,282	416,537
DM-109	VII	"	2	F,G	At Rincon Sea Wall			6- 2-26	R.H. Travers	Concrete Stairways	9,795	870	10,672
393	VII	"	66	A	Huenese Road	3-1/4 Mi. Southeasterly	3.33	8-15-22	Geo. Pollock Co.	Grading	34,565	2,708	37,273
D-397	VII	"	66	A	Point Mugu	Big Sycamore Creek	.73	10-29-21	Day Labor	Grading	108,931	3,160	112,091
414	VII	Ventura Los Angeles	66	A	Huenese Road	Rindge Ranch	11.44	12-13-22	Hauser Const. Co.	Grad. & Gravel Surfacing	887,657	30,905	918,562
D-617	VII	Ventura	66	A	Point Mugu	Oak Creek	6.00	10-16-25	Day Labor	Rip Rap slopes	49,843	93	49,936
506	VII	"	66	A	Point Mugu	Little Sycamore Creek		6-28-26	Christ Thoren	Concrete Pipe Culverts	11,501	931	12,433
513	VII	"	66	A	Oxnard	Huenome Road	4.99	7-30-26	United Conc.Pipe & Const.Co.	Grading & P.C.C. Pave.	165,302	8,326	173,628
D-634	VII	"	66	A	Oxnard	Huenese Road		9-28-26	Day Labor	Moving Buildings	1,932		1,932
	VII	"			Various Locations (EM-44-171)					Minor Improvements	1,880	2	1,882
134	X	Yolo	6	A	Davis	Yolo By-Pass	4.80	4- 6-15	Palser & McBryde	18 ft. Concrete Base	92,410	5,602	98,012
D- 68	X	"	6	A	Davis	Webster	4.29	8-24-15	Day Labor	Oil Surfacing	5,398	151	5,549
D- 98	X	"	6	A	Station 134+14	Station 121+62	.41	3-10-16	Day Labor	18 ft. Concrete Base	4,853	122	4,975
D-105	X	"	6	A	At Station 342+50			5-17-16	Day Labor	Rock Surfacing	20		20
D-147	X	"	6	A	S.P.R.R.Xing at Davis		.23	7- 9-17	Day Labor	Subway-18 ft. Conc. Base	20,838	1,704	22,542
D-148	X	"	6	A	Approach to Yolo Trestle		.90	8- 3-17	Day Labor	15 ft. Concrete Base	18,190	1,215	19,665
86	X	"	6	B	Across Yolo By-Pass		3.13	7-21-14	Graff Const. Co.	Concrete Bridge	404,440	18,638	423,078
160	X	"	6	B	Across Yolo By-Pass		.03	12- 7-15	Security Const. Co.	Barcule Bridge	28,159	2,784	30,943
127	X	"	6	C	Yolo By-Pass	Sacramento River	3.69	4-16-15	Joe Lawrence	18 ft. Concrete Base	49,918	3,799	53,717
D-102	X	"	6	C	Yolo By-Pass	Sacramento-Woodland R.R.	3.56	4- 4-16	Day Labor	Oil Surfacing	2,247		2,247
D-149	X	"	6	C	Approach to Yolo Trestle		1.13	8- 3-17	Day Labor	15 ft. Concrete Base	21,015	1,059	23,074
480	X	"	6	C	At Washington			9- 3-29	Lord & Bishop	Underpass	21,615	1,726	23,341
493	X	"	6	C	At Washington, W.St. Bridge Approach		0.25	2- 8-26	H.V. Tucker Co.	Grading (embankment)	17,715	1,555	19,270
514	X	"	6	C	West Sacramento	W St. Bridge	0.55	7-30-26	Henry Brown	P.C. Concrete Pave.	35,929	3,725	39,654
82	X	"	6-1-A	A	Southerly Boundary	Woodland	12.73	7- 7-14	W. Blumenkranz	15 ft. Concrete Base	104,889	5,273	110,162
D- 67	X	"	6-1-A	A	Southerly Boundary	Woodland	12.91	8-24-15	Day Labor	Oil Surfacing	3,026	201	3,227
M- 82	III-X	"	6-1-A	A	Htw. Putah Cr. & Davis & Woodland Wye & Woodland		12.79	3-23-25	Kaiser Paving Co.	P.C. Conc. Widening	153,462	6,459	159,921
D- 97	III	"	7	A	At Station 220			1-20-16	Day Labor	Pipe Culvert	20		20
DM- 50	X	Yolo-Solano	7	A,B	Putah Creek	Winters Wye	1.3	11-21-25	Day Labor	Asph. Conc. Surface	26,719	1,569	28,288
288	III	Yolo	7	B	Woodland	Zamora	10.71	4-28-20	Geo. S. Benson & Son	15' & 18' Concrete Base	275,334	7,771	283,105
D-394	III	"	7	B	Excentions			8-25-21	Day Labor	Paving Excentions	6,013		6,013
D-539	III	"	7	B	Cache Creek Bridge		.18	6-11-23	Day Labor	Bridge Approaches	5,222	68	5,290
191	III	"	7	C	Blacks	Hershey	10.95	7-12-17	C.H. & A.W. Correll	15 ft. Concrete Base	236,350	8,952	245,302

COMPLETED CONTRACTS—JUNE 30, 1928—Continued

[illegible]	Div.	District	Fed.	Sec.	From	To	Length Miles	Completed Date	Construction	Type of Bid	Construction Cost	Current Expenses	Total
[illegible]	IIII	Yuma	1	A	Maricopa Co. Section Agreement		.02	4-1-27	Day Labor	[illegible] & All Bituminous Mixes	$ [illegible]	$ 46	$ [illegible]
[illegible]	IIII	Yuma	1	A	Wellton & Mohawk	Mohawkville	9.21	4-1-28	F E. Frey	[illegible] Bit. Macadam	[illegible]	4,944	77,[illegible]
[illegible]	IIII	"	1	A	[illegible] Mohawk	Mohawkville	1.90	4-1-28	Day Labor	Bituminous Surf. [illegible] Mix Surf.	31,[illegible]	1,908	22,[illegible]
[illegible]	IIII	"	1	A	Somerton Road	Somerton Boundary	6.85	4-[illegible]-28	Day Labor	Bituminous Surface			
[illegible]	IIII	Yuma-Maricopa	1	A	[illegible] IIII-Mar-[illegible]-A								
[illegible]	III	Yuma	1	A	[illegible] Boundary	Morrison's Crossing	4.33	[illegible]-15-28	E.E. Rankin & Son	[illegible] Concrete Slab	34,[illegible]7	3,[illegible]3	37,[illegible]0
[illegible]	III	"	1	A	[illegible]	[illegible]	.98	[illegible]-1-28	Day Labor:	[illegible] & [illegible] Concrete Base	1,[illegible]3	[illegible]	[illegible]
[illegible]	III	"	1	A	[illegible] Mohawk	1 Mi. S. Mohawk...e	8.80	[illegible]-[illegible]-28	Bituminous & Vernon	Mac. Bitum. & [illegible] Bit. Mac.	138,[illegible]3	4,[illegible]6	142,[illegible]9
[illegible]	III	"	1	A	Southern Pac. R.R.	Extenti/ Boundary	11.07	9-[illegible]-28	Prison Labor	Bituminous	109,[illegible]5	1,627	111,[illegible]2
[illegible]		Generals			Fruitvale, Town Streets,			8-[illegible]-28	Day Labor	Tarvi. Road			31,[illegible]5
[illegible]	V	Yakima			Benton [illegible]			7-[illegible]-28	O.E. Burgess	Penetrating [illegible] Bridges			44,[illegible]6
[illegible]	III	Yakima			Benton [illegible]-5			12-[illegible]-28	Jenkins & Elton	Penetrating [illegible] Bridges			10,[illegible]8

INCOMPLETE CONTRACTS—JUNE 30, 1928

CONTRACT NUMBER	DIV	COUNTY	RTE	SEC	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	EXPENDITURES TO JUNE 30, 1928		
											CONSTRUCTION	CONST ENGR.	TOTAL
[illegible]	IV	Alameda	5	B	Dublin	Hayward	7.6	8-18-27	Aries Knapp Co	Grading & Bit. Mac. Surf	$ 114,135	$14,451	$ 128,586
	X	Amador			Various Locations (21EE4)					Minor Improvements	1,059		1,059
21EE3	X	Amador	34	B	Bet. Jack & Jackson	At R.R. Xing		8-16-27	Day Labor	Reconstruct Underpass	3,756	933	4,689
21EE3	X	"	34	C	East of Jackson		1.35	5-17-28	G.E. Finnell	Grading	3,913	351	4,264
	X	"			Various Locations (21EE13)					Minor Improvements	4,351		4,351
[illegible]	II	Butte	21	B	Feather River Xing	7 Miles North	7	4-25-28	Prison Labor	Grading	21,579	224	21,803
[illegible]	II	"	21	B	Feather River Xing	7 Miles North	7	4-25-28		Payment of Convict Wages			
[illegible]	III	"	45	A	Butte Creek	Cherokee Canal	6.7	2-10-28	Day Labor	Grading	19,189	2,747	21,936
[illegible]	X	Calaveras	26	A	Near Hellman			3- 3-28	Day Labor	Timber Underpass			
[illegible]	X	"	24	A	At Underpass Near Hellman			3-10-28	Day Labor	Grading & Rock Surfacing			
	X	"			Various Locations (21EE10)					Minor Improvements	2,823		2,823
[illegible]	IV	Contra Costa	4	B	El Cierro	Valona		12- 1-27	Day Labor	Guard Rail	3,269	2	3,271
	"	"			Various Locations (21EE19)					Minor Improvements	1,337		1,337
[illegible]	I	Del Norte	1	A	Southerly Boundary	Richardson Creek	3.5	12- 1-27	J.E. Johnston	Grading & Rock Surfacing	72,331	7,799	80,130
[illegible]	I	"	1	A	Klamath River	Wilson Creek	7.3	11-25-28	J.E. Johnston	Grade Rock Surf. & Timber Br	50,706	1,798	52,504
[illegible]	I	"	71	A-B	Crescent City	0.7 Mile S.of Ore.Line	21.6	5-25-28	Holdener Const.Co	Rock Surfacing		380	380
[illegible]	I	"	1	C	At Smith River About 8 Mi	E. of Crescent City		4-17-28	Parker-Schram Co	Grading & Steel Bridge	1,946	1,237	3,182
[illegible]	I	"	1	C	Crescent City	Adams Station	17.2	4-24-24	Prison Labor	Grading	666,776	25,257	692,033
[illegible]	I	"	1	C-D-E	Smith River	Oregon Line	39.3	5-23-28	Holdener Const. Co	Oiled Rock Surfacing		580	580
[illegible]	I	"	1	B	Wilson Creek	Crescent City(portions)	15	4-21-27	Webber Const Co	Rock Surfacing	17,685	919	18,604
[illegible]	I	"	71	B	Oregon State Line	0.7 Mile South	0.7	5-29-28	John R. Hill	Grading & Rock Surfacing		208	208
	I	"			Various Locations (21EE4-10)					Minor Improvements	4,699	518	5,217
[illegible]	III	El Dorado	11	F-G	Sportsman Hall	Riverton (portions)	3.6	4- 7-28	Day Labor	Grading	2,266	346	2,612
[illegible]	III	"	11	F-G	From Pond	3/4 Mile E.of Riverton	6.2	5-10-28	Day Labor	Grading & Oiled Rock Surf.			
[illegible]	III	"	11	F-G	From Pond	3/4 Mile E.of Riverton	6.2	5- 7-28	Harold Smith	Furnish & Stockpile Rock Surf	3,309	302	3,611
[illegible]	III	El Dorado-Pla	38	B-C-A	Emerald Bay	Tahoe City	11.3	6-21-27	Day Labor	Grading	48,750	5,366	54,116
[illegible]	III	El Dorado	38	B-C	Eagle Falls	Meeks Bay (portions)	3.3	5-17-28	C.D. Contoulee	Grading	1,712	759	2,471
[illegible]	III	El Dorado-Pla	38	C-A	Meeks Bay	Tahoe City (portions)	8.3	3-30-28	Day Labor	Oiled Rock Surfacing	7,678		7,678
	III	El Dorado			Various Locations (21EE12)					Minor Improvements			
[illegible]	VI	Fresno-Madera	4	C-A	Across San Joaquin River			4-28-28	Carl H. Peterson	Steel Bridge	5,811	776	6,587
[illegible]	VI	Fresno	10	A-B-C	West Boundary	2 Mi.E.of Parkfield Jct	16.5	12-30-27	Day Labor	Grading & Rock Surfacing	15,564	36	15,600
	VI	"			Various Locations (21EE-)					Minor Improvements	10,791	190	10,981
[illegible]	III	Glenn	7	C	Through Orland		1.1	5-21-28	C.W. Wood	Grading & P.C.C. Pavement	482	339	821
[illegible]	III	"	47	A	Orland	Hamilton City	5.	4- 3-28	Force,Currigan & McLeod	Furnishing Rock Surfacing	6,270	33	6,303
[illegible]	III	"	47	A	3/4 Mi E of Orland	Easterly Boundary	6.2	2-27-28	Day Labor	Grading	7,489	1,714	9,203
	III	"			Various Locations (21EE11-15-16)					Minor Improvements	891	20	911
[illegible]	I	Humboldt	1	G	Beatrice	Eureka	8.0	9-27-27	Day Labor	Oiled Rock Borders	1,772		1,772
[illegible]	I	"	1	G	Beatrice	Eureka (portions)		4-25-28	Day Labor	Grading & Rock Surfacing	2,455	359	2,814
[illegible]	I	"	1	G	Fernbridge	Loleta	2.1	4- 6-28	Day Labor	Oiled Rock Surfacing			
[illegible]	I	"	1	K	Orick	Sec. 36 T 12 N R.1 E	8.15	5-11-27	W.H.Hauser	Grading & Rock Surfacing	190,930	1,671	192,601
[illegible]	I	"	1	K	Sec. 36, T 12 N, R.1 E	Northerly Bdry	6.77	5-11-27	Engelhart Pave & Const.Co	Grading & Rock Surfacing	180,805	441	180,706
[illegible]	I	"	1	K	Across Redwood Cr.	1/4 Mi.North of Orick		7-28-27	Mercer-Fraser Co	Reinf.Conc. Girder Bridge	74,413	3,807	78,220
[illegible]	I	"	1	K	Across Prairie & Lost Man Creeks			3-23-28	E.B. Skeele	Reinf.Conc. Girder Bridges	5,322	227	5,549
[illegible]	I	"	1	A-B-C	See Mendocino Co								
[illegible]	I	Mendocino	1	J-K									
	I	Humboldt			Various Locations (21EE4-7-10-11)					Minor Improvements	42,081	1,224	43,305
[illegible]	VIII	Imperial	12	C	Seeley	El Centro	7.2	3- 3-28	Jahn & Bressi Co. Inc	A.C. Widening & Surfacing	34,547	2,191	37,038
[illegible]	VIII	"	80	B-C-D	Trifolium Drainage Canal	Arroyo Salado Wash	19.7	3-23-28	Conway & Morrow	Drainage Ditches & Bridges	19,519	1,981	21,500
	VIII	"			Various Locations (21EE-)					Minor Improvements	5,583		5,583
[illegible]	IX	Inyo	23	B-C	Tinnemaha Dam	Big Pine	6.8	6- 6-28	Montfort & Armstrong	Oiled Rock Surfacing			

INCOMPLETE CONTRACTS—JUNE 30, 1928—Continued

CONTRACT NUMBER	DIST.	COUNTY	ROUTE	SEC.	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	EXPENDITURES TO JUNE 30, 1928		
											CONSTRUCTION	CONST. ENGR.	TOTAL
99F3	IX	Inyo	23	G	At Bishop	In Bishop		1- -28	Day Labor	Reinf. Conc. Box Culvert	$ 2,017	$ 158	$ 2,175
9994	IX	"	23	I	Keeler	Olancha (portions)		1-18-28	Day Labor	Decomposed Granite Surf	4,394		4,394
					[illegible]					Minor Improvements	10,880	386	11,266
99W1	IX	"	23	L	[illegible]	Alabama Gate	6.5	4- -28	Southwest Paving Co	Grading & Oiled Rock Surf		930	930
99F5	"	"	23	M	Bishop Creek	Nor. Fk. Mount Freeman	8.4	5-14-28	Day Labor	Grading	7,838	874	8,712
	VI	"			[illegible]					Minor Improvements	10,383	385	10,768
(D-651)	III	[illegible]	[illegible]	1	[illegible]	Ambrett Mine		3-30-26	Prison Labor	Grading	177,[illegible]	11,507	188,[illegible]
99V1	III	"	[illegible]	1	[illegible]	Ambrett Mine		11-16-27	"	Payment of Convict Wages	4,680		4,680
531	III	"	15	2	Antelope Summit [illegible]			6-19-28	Otto Fruitier	Reinf. Conc. Tubular Bridge			
	IV	"			[illegible]					Minor Improvements	1,595		1,595
9877C1	II	[illegible]	29	B-A	San Pierre Jct.								
	II	[illegible]			[illegible]					Minor Improvements	[illegible]		[illegible]
9779	VII	San Antonio	4	2	Arcadia	2 Mi N of Monrovia		3-17-28	Day Labor	Experimental Paving	[illegible]		[illegible]
9771	VII	"	4	B-C	Duarte-Mayer, Section	2.2 Mi N of Bradberg		6-30-27	Day Labor	Widening Roadway	[illegible]	101	[illegible]
97W1	VII	"	3	A	At La Crescenta			3- -28	A E Nelson	Maintenance Buildings	1,128		1,128
911VW1	VII	"	6	E	Antelope Switch Army Mule	At Arcadia		5-10-28	Whipple & Seegert	Reinf. Conc. Girder Bridge	[illegible]	[illegible]	[illegible]
97F5	VII	"	9	D	Monrovia	Azusa	3.5	4-14-28	Gibbons & Reed	Grading & A C Pavement	[illegible]	[illegible]	[illegible]
97W4	VII	"	60	A	Arroyo Seco	Los Alisos Creek	1.5	4-16-28	Leslie Contst Co	Grading	[illegible]	[illegible]	[illegible]
9774	VII	"	60	A-B	Eagle Rock	Los Flores Canyon		8-[illegible]-27	Day Labor	Placing Rk. Rap	36,[illegible]		36,[illegible]
97W2	VII	L. A. [illegible]	60	A-B-A	San Fernando Jct.								
	VII	Los Angeles			Various Locations (9774)					Minor Improvements	[illegible]		[illegible]
9822	VI	Madera		A	[illegible]	Arcola School	6.5	3-23-28	The Chilnhar Const Co	Asph. Conc. Pavement	51,813	3,170	[illegible]
9117C4	VI	Madera-Fresno		A-C	San Fresno Jct.								
94E7	IV	Marin	1	A	[illegible]	Swillman Creek	4.9	4-28-28	Hanneman Co	Grading & P C C Pave	7,898	1,143	[illegible]
(9681)	VI	Mariposa	18	D-E	Middleton	Briceburg	13.47	7- 1-27	Prison Labor:	Grading	111,[illegible]	[illegible]	[illegible]
(96C1)	VI	Mariposa	18	D-E	Middleton	Briceburg		7- 1-27		Payment of Convict Wages	[illegible]	5,957	[illegible]
(911C1	I	Mendocino	1	J-K)	Ukiah	Leggettville	31.5	6- 4-28	Smith Bros. Co	Furnishing Crushed Rock			
(91K1	I	Humboldt	1	A-B-C)									
	I	Mendocino			Various Locations (91E59-1 [illegible] (9[illegible]-[illegible]-14.15-A)					Minor Improvements	[illegible]		[illegible]
911E13	VI	Merced	4	A	1 Mi S of Merced	1 Mi S of Merced		10-31-27	S C Whitty	2 Reinf. Conc. Bridges	[illegible]	[illegible]	[illegible]
92W1	II	Modoc	28	C	Goldfield Junction	14 Mi W of Nevada Line		3-[illegible]-28	Day Labor:	Grading & Gravel Surf	[illegible]		[illegible]
D-671	II	"	28	B	At Hillsdale Cr. Bridge			6-[illegible]-27	Day Labor	Grading Approaches	[illegible]		[illegible]
	II	"			Various Locations (9[illegible]-A)					Minor Improvements	[illegible]		[illegible]
99T1	II	Mono	23	A-B-C-D-E-I	Various Locations			11-[illegible]-27	Day Labor	1,501 Ft. Guard Rail	1,[illegible]		[illegible]
99T5	IX	"	23	K	Benton Junction	Little Antelope Creek	14.0	4- -28	Day Labor	Widening Roadway	[illegible]		[illegible]
95B01	V	Monterey	2	A-B-C	Castroville Breakwater	Camphora (portions)	6.3	6-[illegible]-28	Fred W Wightwort	Bituminous Macadam Surf	6,[illegible]	358	[illegible]
98E1	V	"	10	B-C	Priest Valley	Priest Valley	3.45	4-[illegible]-28	Day Labor	Widening & Rock Surfacing	[illegible]	5	[illegible]
529	V	"	56	A	Andrew Molera Dr	19 Mi N of San Simeon	8	6-[illegible]-28	Terr. M. Maine	Timber Bridge	[illegible]	348	[illegible]
(D-679	V	"	56	A	Salmon Creek	4 Mi. N of Salmon Cr	6	10-[illegible]-27	Prison Labor:	Grading	50,[illegible]	3,241	[illegible]
(99V2	V	"	56	A	Salmon Creek	4 Mi N of Salmon Cr	9	2-[illegible]-28		Payment of Convict Wages	[illegible]		[illegible]
					Various Locations (9[illegible]-1)					Minor Improvements	[illegible]	71	[illegible]
93W3	III	Nevada-Placer	40	A-B	San Pierre Jct.								
	III	Nevada			Various Locations (9[illegible])					Minor Improvements	[illegible]		[illegible]
97F6	VII	Orange	4	B	Anaheim	1 Mile North	0.9	5-[illegible]-28	Bent Culvert	Grading & Oiled Rock Surf	[illegible]	567	[illegible]
9117F8	VII	"	[illegible]	B-C	San Juan Capistrano	Depot		1-[illegible]-28	Fred M. White	Pav Relief Conc. Bridges	[illegible]	[illegible]	[illegible]
521	VII	"	8-60	A-C	San Juan Jones	Serra	0.92	4-[illegible]-27	V.R Dennis Const Co	Grading, P C C & Bit Mac. Pave	[illegible]	5,784	[illegible]
D-678	VII	"	60	2	Santa Ana-Upgrade Kings			1- -27		Bridge Share of Cost	[illegible]		[illegible]
D-676	VII	"	60	2	Upgrade Bench	San Juan Creek	7.5	4-[illegible]-27	Day Labor	Cl. Treating Rock Surfacing	10,[illegible]	306	10,[illegible]
	VII	"			Various Locations (9777[illegible])					Minor Improvements	1,702		1,702
9117[illegible]	III	Placer	[illegible]	[illegible]	At Emeryville Shell	Near Antelope		10-[illegible]-27	State's Share	Concrete Pipe Sipson			
[illegible]		"	[illegible]	[illegible]	Orchard	Shelter House No. 1	[illegible]	12-[illegible]-27	Hy Nelson	Rock Surfacing	9,[illegible]	493	10,[illegible]

CONTRACT NUMBER	DIV.	COUNTY	RTE.	SEC.	FROM		LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	EXPENDITURES TO JUNE 30, 1928		
											CONSTRUCTION COST	ENGR. EXPS.	TOTAL
911W1	III	Placer	38	A	Across Truckee River	At Tahoe City		6-13-28		Purchase of Timber for Br.	$	$	$
911W01	III	"	38	A	Across Truckee River	At Tahoe City		6-30-28	Paul M. White	Reinf. Conc. Girder Bridge			
93W3	III	Placer-Nevada	38	B-A	Tahoe City	Truckee		6-29-28	State's share	Underpass & Overpass			
93E1	III	" -El Dorado	38	A,B,C	See El Dorado Co.								
(D-682	II	Plumas	21	B	Twain	Keddie		4-25-28	Prison Labor	Grading	31,803	489	32,292
(92M4	II	"	21	B	Twain	Keddie		4-25-28		Payment of Convict Wages	3,506		3,506
D-671	II	"	89	A	At Lake Almanor	Collegeway Approaches		9-15-27	Day Labor	Rock Surfacing	2,477		2,477
92T02	II	"	89	A	Westerly Boundary	24 Mi. S.W. of Chester	6.2	5-26-28	Chas. Harlowe Jr.	Grading & Rock Surfacing		1,180	1,180
911T03	II	"	89	A	Across Rock & Billy Creeks			4-28-28	C.F.Hertziger	Two Reinf. Conc. Bridges	2,151	660	2,811
92TC1	II	Plumas-Lassen	89	A-B	Chester	Bonville Corral	12.4	5-23-28	E.B. Bishop	Rock Surfacing	4,632	427	5,059
	VIII	Riverside			Various Locations (98FF1-19)					Minor Improvements	4,123		4,123
910B02	X	Sacramento	4	A	1 Mi. So. of Arno	1 Mi N. of Arno	1.8	11-19-27	Mankel & Staring	Grading & Rock Surfacing	9,846	1,839	11,685
911B07	X	"	4	A	Near Arno			9- 2-27	M.A. Jenkins	Two Reinf. Conc. Bridges	16,078	2,689	18,767
9118017	X	"	4	A	Galt	Arno		5-25-28	Geo.J.Ulrich Const.Co.	Five Reinf. Conc. Bridges		494	494
910B09	X	"	4	B	McConnell Station	Sacramento	13.1	4- 5-28	Mankel & Staring	Oiled Rock Borders	21,465	992	22,447
9118015	X	"	11	B	At Brighton			3-15-28	McGillivray Const.Co.	Undergrade Crossing		1,696	1,696
910K01	(	"	33	A	At New Hope			5-25-28	Ben C. Gerwick, Inc.	Bridge Approaches			
	(III	"			Various Locations (91EE14)					Minor Improvements	570		570
	(X												
94W01	IV	San Benito	22	B	At Pacheco Creek	Bridge		12- 1-27	Day Labor	Grade & Surf. Br.Approaches	4,693		4,693
9454	VIII	San Bernardino	26	A	At Santa Ana R. Br.			3-22-28	Day Labor	Grading & Surf. Br.Approaches	2,014		2,319
9411T02	VIII	" "	26	A	Across Warm Cr., Santa Ana R. & Mission Storm Drain			10-18-27	Reinhold Johnson	Three Reinf. Conc. Bridges	62,107	1,029	63,136
9411F03	VIII	" "	26	A	Across San Timoteo Cr			6- 6-28	E.S. Pershan	Timber Bridge	205	38	243
9801	VIII	" "	43	A	Squirrel Inn	The Pass	5.7	4-19-28	State's share	Grading & Surf.	91,949		91,949
9802	VIII	" "	43	A	Waterman Saddle	Pumpkin Point	1.21	5-28-28	Day Labor	Oil Treating, rock surfacing			
98F2	VIII	" "	43	B	Running Springs Park	4.7 Miles West	5.7	5-15-27	Day Labor	Grading	46,953	1,355	47,308
98003	VIII	" "	43	B	Running Springs Park	Summit	4.5	5-18-28	Day Labor	Oil Treating, rock surfacing			
98001	VIII	" "	43	B-C	Running Springs Park	Big Bear Lake Dam	14.2	4-17-28	Day Labor	Oil Treating, rock surfacing	9,311	139	9,450
98002	VIII	" "	43	B-C	(Summit	3 Mi. E. of Sec. C.)	4	4-24-28	Day Labor	Disintegrated Granite Surf	3,538		3,538
					(Deep Creek	1 Mi.W. of Sec. B.)							
	VIII	" "			Various Locations (98FF5-7-8-13-14-15-16-17-18-20-21)					Minor Improvements	22,690		22,690
SM-189	VII	San Diego	2	C	At Las Flores			11-16-26	State's share	Underpass			
97F8	VII	" "	15	A	Euclid Ave	East City Limits		1-16-28	State's Share	Pavement			
97F04	VII	" "	12	E	3 Mi. S.E. of Pine Valley	Buckman Springs	2.0	2-27-28	John. & Bressi Co.Inc.	Grading	32,817	2,426	35,243
	VII	" "			Various Locations (97FF6-7)					Minor Improvements	2,307		2,307
910B06	X	San Joaquin	5	B	San Joaquin Riv	French Camp	6.8	4- 3-28	Fredrickson Bros. and Fredrickson & Watson Const. Co	P.C.C. Pave	41,838	3,465	45,303
95F04	V	San Luis Obispo	2	D	Near San Luis Obispo		0.2	3-14-28	J.F. Collins	Grading & Minimum Surf.	6,646	566	6,982
95F2	V	" " "	2	E	Pismo	San Luis Obispo		4-17-28	Day Labor	Oil Treating rock surfacing	1,084		1,084
95F02	V	" " "	2	E	Pismo	San Luis Obispo	11.0	9-30-27	J.F. Knapp	P.C.C. Pave. & Rock Surf.	267,555	11,954	279,509
911F07	V	" " "	2	E	Across San Luis Obispo Creek			5-12-28	Chas. & F.W. Steffgen	Reinf. Conc. Girder Br.		180	180
95X1	V	" " "	33	B-C	East of Cholame Flats			4-25-28	Day Labor	Quarry Site Test Holes	316		316
	V	" " "			Various Locations (95FF1)					Minor Improvements	7,839	128	7,967
94W01	IV	San Mateo)	56	D)	La Honda Road	Sarratoga Gap	13.8	4-25-28	Twohy Bros.)	Grading & Rock Surfacing	72,213	8,936	81,149
(94C01		Santa Clara)	56	E)					J F Shea Co.)				
		Santa Cruz)	56	A)									
94T72	IV	San Mateo	68	B	South San Francisco	Broadway Station	5.2	3-24-28	Day Labor	Oil Treating Rock Surfacing	10,315		10,315
94T02	IV	San Mateo	68	B-C	Broadway Station	Fifth Ave	3.0	5- 7-28	C.W.Wood	Grading & Rock Surfacing	14,322	1,725	16,047
	V	Santa Barbara			Various Locations (95FF4)					Minor Improvements	4,803	26	4,829
(94C01	IV	Santa Clara)	56	E)	See San Mateo Co								
94C01	IV	Santa Cruz)	56	A)									
	IV	San Mateo)	56	D)									

INCOMPLETE CONTRACTS—JUNE 30, 1928—Continued

DISTRICT NUMBER	DIV	COUNTY	RTE	SEC	FROM	TO	LENGTH MILES	CONTRACT DATE	CONTRACTOR	TYPE OF WORK	EXPENDITURES TO JUNE 30, 1928		
											CONSTRUCTION	OTHER THAN CONST.	TOTAL
[illegible]	IV	Santa Clara			Various Locations (7-KE[illegible])					Minor Improvements	$ 2,127	$	$ 2,127
[illegible]	IV	Santa Cruz	48	A	Boulder Creek	Calif. Redwood Park		3-10-28	Day Labor	Oiled Rock Surfacing	11,[illegible]		11,[illegible]
(9490[illegible]	IV	(Santa Cruz	56	A)	See San Mateo Co.								
(9490[illegible]	IV	(Santa Cruz	56	B)									
	IV	(San Mateo	5	D)									
92902	II	Shasta	1	D	Cohasset	Northerly Boundary	6.3	4-19-28	R. Johnson	Grading & Rock Surfacing	13,960	4,554	M,513
92903	II	"	1	D	Shotgun Creek	Cohasset	5.8	6-20-28	Matthews Const. Co	Grading & Rock Surfacing		494	494
7118016	II	"	3	D	Across Bowman Creek			4-17-28	Noble Bros.	Reinf. Conc. Arch Bridge		755	755
D-675	II	" -Trinity	88	A-B	See Trinity Co.								
92901	II	"	89	C	Montgomery Creek	3 Mi. W. of Burney	17.0	5-17-28	A. Miller	Rock Surfacing	3,[illegible]	230	4,035
	II	"			Various Locations (7-KE[illegible])					Minor Improvements	7,365		7,365
92901	II	Siskiyou	46	B	At Fort Goff Warehouse Station			5-19-28	James M. Logan	Maintenance Buildings			
910808	I	Solano	8-7	A-B	Dardelia	Rockville	3.1	6-10-28	Lofland Bros.	Grading & Oiled Rock Surf.		71	71
9492	IV	Sonoma	6	A-B	At Sonoma Creek			6- 4-28	Day Labor	Oil Treatment of Rock Surf.	414		414
	IV	"			Various Locations (7-KE[illegible])					Minor Improvements	1,012		1,012
910809	I	Stanislaus	4	B	Near South Approach of Stanislaus R. Br.		0.04	6-[illegible]-28	J. W. Hook	Grading & Oiled Rock Surf.		12	12
911702	III	Sutter			Sutter By Pass			5-[illegible]-28	Morrison-Knudsen Co.	Timber Bridge	18,[illegible]	1,646	19,726
(D-680	II	Tehama	32	A	Paynes Creek	7.2 miles West		2-[illegible]-28	Prison Labor	Grading	41,[illegible]	1,740	[illegible],781
(9292	II	"			" "	" "		2-[illegible]-28		Payment of Convict Wages	8,[illegible]		8,285
	II	"			Various Locations (9-KE[illegible]-20)					Minor Improvements	9,[illegible]		9,231
(D-681	II	Trinity	20	B	Van Long Gulch	Easterly Boundary		2-[illegible]-28	Prison Labor	Grading	15,[illegible]	2,503	17,141
(9293	II	"	20	B	" "	" "		2-[illegible]-28		Payment of Convict Wages	[illegible],[illegible]		[illegible],817
(D-675	II	" -Shasta	88	B-A	Easterly Boundary	Tower House	21.5	10-[illegible]-27	Prison Labor	Grading	70,[illegible]	4,651	75,177
(9291	II	" "	88	B-A	" "	" "	21.5	1-10-[illegible]		Payment of Convict Wages	[illegible],[illegible]		[illegible],[illegible]
D-677	II	"	88	D	At Trinity R. Br.		0.4	10-[illegible]-27	Day Labor	Grading	[illegible],[illegible]	[illegible]	[illegible],667
	II	"			Various Locations (9-KE[illegible])					Minor Improvements	3		3
911709	VI	Tulare	4	F	Tulare	3 Mi. S. of Goshen		6-30-28	Day C. Noble	Five Reinf. Conc. Bridges			
91071	I	Tuolumne	13	A-B	Keystone	Jamestown	9.0	6- [illegible]-28	Day Labor	Grading			
	I	"			Various Locations (9-KE[illegible]-10)					Minor Improvements	6,[illegible]		6,463
9771	VII	Ventura	60	A	Mcenzie Road	Little Sycamore Creek		6-30-28	Day Labor	Bank Protection			
9772	VII	Ventura	60	A	Point Mugu	Dot Creek	6.0	7- 6-27	Day Labor	Placing Rip Rap	10,[illegible]		10,624
97702	VII	(Ventura	60	A)	Little Sycamore Creek	Lavigo Creek	11.8	1- [illegible]-28	Southwest Paving Co.	Oil Treated Rock Surf	72,[illegible]	7,790	79,965
		(Los Angeles	60	A-B)									
	VII	Ventura			Various Locations (977[illegible])					Minor Improvements	1,030		1,030
910807	X	Yolo	6	C	Yolo Causeway	1½ Miles East	1.5	6- 5-28	D. McDonald	Grading & Oiled Rock Bond	1,457	162	1,619
	III	Yuba			Various Locations (9-KE[illegible])					Minor Improvements	1,999	67	2,066

AVERAGE CONTRACT PRICES

1912 to June 30, 1928

11—63390

AVERAGE CONTRACT PRICES, [1]1912-1916 (INCLUSIVE)

Portland Cement Concrete Pavement

Year	[1]Grading (per cu. yd.)	Asphalt concrete, including all materials (per ton)	Concrete, including all materials (per cu. yd.)	Sand, delivered (per ton)	Broken stone and gravel, delivered (per ton)	Cement delivered (per bbl.)	[2]Concrete, exclusive of materials (per cu. yd.)
1912	$0 39	$6 04	$5 82	[3]	[3]	$1 61	[3]
1913	46	6 46	5 91	$0 56	$0 58	1 65	$2 56
1914	51	6 71	6 75	54	85	1 70	3 03
1915	45	6 80	6 26	58	76	1 74	2 84
1916	37	.....	6 37	60	76	1 80	2 90
[4]Average	$0 49	$6 49	$6 35	$0 56	$0 78	$1 70	$2 92

AVERAGE CONTRACT PRICES, [1]1917 AND 1918

Portland Cement Concrete Pavement

Year	[1]Grading (per cu. yd.)	Asphalt concrete, including all materials (per ton)	Concrete, including all materials (per cu. yd.)	Sand, delivered (per ton)	Broken stone and gravel, delivered (per ton)	Cement delivered (per bbl.)	[2]Concrete, exclusive of materials (per cu. yd.)
1917	$0 73	$8 52	[3]$8 03	$0 66	$0 86	$1 80	$4 17
1918	78	.....	[3]10 51	1 05	1 28	2 20	5 53
[4]Average	$0 74	$8 52	$8 67	$0 76	$0 96	$1 90	$4 51

AVERAGE CONTRACT PRICES, [1]1919 AND 1920 (TO JUNE 30, 1920)

Portland Cement Concrete Pavement

Year	[1]Grading (per cu. yd.)	Asphalt concrete, including all materials (per ton)	Concrete, including all materials (per cu. yd.)	Sand, delivered (per ton)	Broken stone and gravel, delivered (per ton)	Cement delivered (per bbl.)	[2]Concrete, exclusive of materials (per cu. yd.)
1919	$0 96	$9 07	$13 08	$1 10	$1 33	$2 64	$6 37
[5]1920	1 10	.....	16 25	1 23	1 41	2 68	7 64
[4]Average	$1 01	$9 07	$14 82	$1 17	$1 37	$2 66	$7 00

AVERAGE CONTRACT PRICES, [1]1921 AND 1922

(Costs are from June 30, 1920, to June 30, 1921, and June 30, 1921, to June 30, 1922)

Year	[1]Grading (per cu. yd.)	Asphalt concrete, including all materials (per ton)	Concrete, including all materials (per cu. yd.)	Sand, delivered (per ton)	Broken stone and gravel, delivered (per ton)	Cement delivered (per bbl.)	[2]Concrete, exclusive of materials (per cu. yd.)
1921	$0 94	$9 40	$17 34	$1 74	$2 09	$3 39	$7 97½
1922	71	7 92	14 29	1 47	1 77	3 10	5 01
[4]Average	$0 78	$7 98	$15 75	$1 63	$1 94	$3 23	$6 96

AVERAGE CONTRACT PRICES, [1]1923 AND 1924

Costs are from June 30, 1922, to June 30, 1923, and from June 30, 1923, to June 30, 1924

Year	[1]Grading (per cu. yd.)	Asphalt concrete, including all materials (per ton)	Concrete, including all materials (per cu. yd.)	Sand, delivered (per ton)	Broken stone and gravel, delivered (per ton)	Cement delivered (per bbl.)	[2]Concrete, exclusive of materials (per cu. yd.)
1923	$0 74	$8 10	$13 18	$1 31	$1 80	$2 96	$5 16
1924	75	7 27	13 49				
[3]Average	$0 74	$7 75	$13 40	$1 31	$1 80	$2 96	$5 16

AVERAGE CONTRACT PRICES, [1]1925 AND 1926

(Costs are from June 30, 1924 to June 30, 1925, and from June 30, 1925 to June 30, 1926

Year	[1]Grading (per cu. yd.)	Asphalt concrete, including all materials (per ton)	Portland cement concrete pavement, including all materials (per cu. yd.)
1925	$0 59	$6 43	[7]$10 85
1926	44	5 13	[7]10 58
[3]Average	$0 53	$5 80	$10 73

AVERAGE CONTRACT PRICES, [1]1927 AND 1928

(Costs are from June 30, 1926 to June, 30, 1927, and from June 30, 1927 to June 30, 1928

Year	[1]Grading (per cu. yd.)	Asphalt concrete, including all materials (per ton)	Portland cement concrete pavement, including all materials (per cu. yd.)
1927	$0 59	$5 68	[8]$10 74
1928	56	4 70	[8]10 23
[3]Average	$0 54	$4 89	$10 56

[1] Includes all classifications, except that structure excavation and preparation of subgrade not included in the averages for 1924 to 1928. These items were bid on separately from the grading.

[2] Contractors bid upon this item in most cases prior to June 30, 1923, the state supplying all materials.

[3] Only a six-month period, January 1, 1920 to June 30, 1920.

[4] In 1912 contractors in all cases except one furnished concrete aggregates.

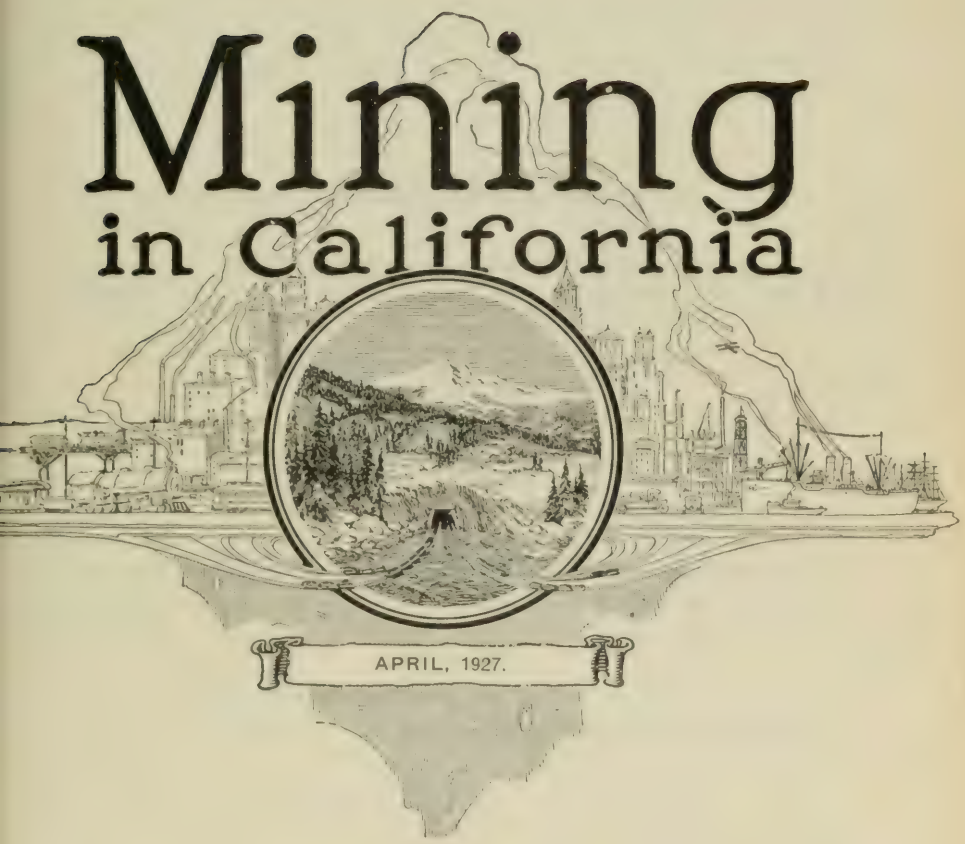
[5] Weighted average.

[6] In 1917 and 1918 the paving concrete was enriched from 1:2½:5 mixture to 1:2:4. In the prices stated, allowance has been made for this change.

[7] From June 30, 1923, to June 30, 1928, all materials were furnished by the contractors.

63390 4-29 5150

Mining in California



APRIL, 1927.

PUBLISHED QUARTERLY

CALIFORNIA STATE
MINING BUREAU

FERRY BUILDING
SAN FRANCISCO

CALIFORNIA STATE MINING BUREAU

EXECUTIVE AND TECHNICAL STAFF

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State Mineralogist

WALTER W. BRADLEY
Deputy State Mineralogist

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W. F. Dietrich, Ceramic Engineer - - - - - - San Francisco

DEPARTMENT OF PETROLEUM AND GAS

R. D. Bush, State Oil and Gas Supervisor - - - - - San Francisco

Note.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the State Mining Bureau, entitled 'Summary of Operations, California Oil Fields.'

CALIFORNIA STATE MINING BUREAU

FERRY BUILDING, SAN FRANCISCO

LLOYD L. ROOT — State Mineralogist

Vol. 23 — APRIL, 1927 — No. 2

CHAPTER OF

REPORT XXIII OF THE STATE MINERALOGIST

COVERING

MINING IN CALIFORNIA

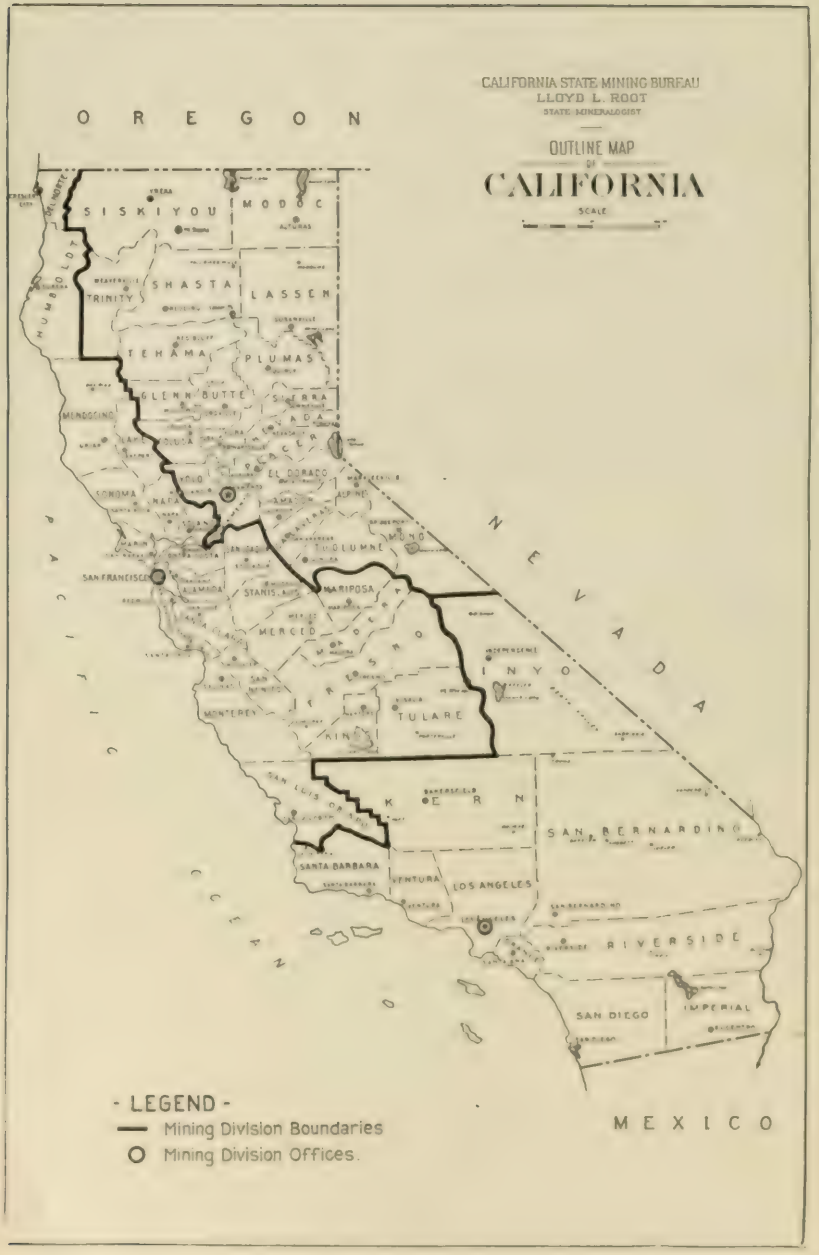
AND THE

ACTIVITIES OF THE STATE MINING BUREAU

CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1927

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LLOYD L. ROOT
STATE MINERALOGIST
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Mining Division Boundaries
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PREFACE.

The State Mining Bureau is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing, quarterly publication was begun in September, 1923.

For the same reason, beginning with the January, 1924, issue, it has been necessary to charge a subscription price of $1 per calendar year, payable in advance; single copies, 25 cents apiece. 'Mining in California' will continue to be sent without charge to our exchange list, including schools and public libraries, as are also other publications of the State Mining Bureau.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the Bureau will not discontinue its practice of issuing from time to time technical reports on special subjects. A list of such reports now available is appended hereto, and the names of new bulletins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Mining Bureau is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.

DISTRICT REPORTS OF MINING ENGINEERS.

In 1919–1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively. This move brought the Bureau into closer personal contact with operators, and it has many advantages over former methods of conducting field work. In 1923 the Redding and Auburn field offices were consolidated and moved to Sacramento.

The boundaries of each district were adjusted and the counties now included in each of the three divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

New County Reports.

The series of separate reports on the mines and mineral resources of the different counties, that together comprise the State Mineralogist's Reports XIV to XVII, inclusive, in the case of many of the counties have become exhausted. Those still in stock are in need of revision. It has been thought advisable, therefore, beginning with the January, 1925, issue of 'Mining in California,' to make the district engineers' reports in the form of a complete general report on the mines and mineral resources in one or more of the counties in each district.

This program will be followed as near as possible in succeeding numbers of the quarterly until each county in the state has been covered.

SACRAMENTO FIELD DIVISION.

C. A. Logan, Mining Engineer.

AMADOR COUNTY.

Geography.

East of the Sacramento Valley, and extending from the lower foothills to the summit of the Sierra Nevada, Amador is the central one of the Mother Lode group of counties, which are similar as regards climate, geography and natural resources. Amador is smaller in area than its neighbors, and contains only 601 square miles. The population of about 8000 is concentrated in a group of small towns extending along the course of the Mother Lode, including Jackson, the county seat, four miles north of the Calaveras County line; Sutter Creek, Amador City, Drytown and finally Plymouth, near the northerly end of the county.

All of these were early day mining towns, whose entire history has been connected intimately with the successful operation of one or another group of the many gold quartz mines. Ione, west of the Mother Lode, is the seat of an active clay mining region and had formerly active coal mines. Oleta, Volcano, Pine Grove and a few other small settlements east of the lode are placer mining towns of the early days. The higher mountainous part of the county is limited in area, but there is a large acreage of foothill land in the western section, which is divided into ranches devoted to grazing. Mining is the principal industry.

A lateral of the state highway system extends from Stockton to Ione, thence to Jackson, Pine Grove and over the summit to Hope Valley in Alpine County, where it connects with similar roads leading to Lake Tahoe and into Nevada. Another highway from Sacramento connects near Plymouth with the Mother Lode road, a north and south road which extends along the Mother Lode region from Auburn to Placerville, Plymouth, and thence south to Sonora. The county is thus seen to be well provided with roads. A branch of the Southern Pacific railroad extends from Galt to Ione, where it connects with the Amador Central, running as far as Martel, serving the mines in the vicinity of Jackson and Sutter Creek.

Timber, Water and Power.

There is timber suitable for mining in the mountains east of the Mother Lode. Some of the mines ship in heavy Oregon pine timber in addition to utilizing the local supply. Water and power for mining and milling are supplied all along the Mother Lode section of the county by Pacific Gas and Electric Company.

Geology and Mineral Resources.

White clay forms a conspicuous part of the Ione (Tertiary) beds, which extend across the entire west side of the county from north to south. This and other colored clays nearby form the basis of an important industry, supplying potteries in various parts of the state.

Also associated with the Ione beds, and usually within 100 feet or less of the surface, near Carbondale, Ione, Buena Vista and Lancha Plana, occur numerous deposits of brown lignite. This was mined at several places until a few years ago, the branch railroad having been built to Ione primarily to serve the coal mines.

Farther east, alternating beds of Mariposa (Jurassic) black slate, amphibolite schist, serpentine and Calaveras (Carboniferous) rocks extend northwest, parallel to the axis of the mountain range of which they form the flank. In the amphibolite schist numerous copper mines and prospects occur, but are all idle now. Chromite occurs in the serpentine, and many small lenses of limestone in the Carboniferous rocks. These formations begin about a mile east of Ione and extend for seven miles eastward, where the Mother Lode mines occur, in another belt of black Mariposa slate. This slate enters the county at Middle Bar bridge on Mokelumne River, running thence northwest through and beyond the county. With an average width of about one-half mile, and in many of the mine workings narrowing to only a few hundred feet, this slate belt and the immediately adjoining and at times intercalated areas of altered igneous rocks contain all the important gold quartz mines of the county.

To the east of the Mother Lode the rocks are nearly all of Carboniferous age for a distance of ten miles, until an elevation of about 3000 feet is reached, where the granodiorite forming the core of the mountains appears. At Oleta in the northern part of the county and at Volcano much placer gold has been produced. A series of detached gravel bodies covered by rhyolite and andesite extends across the county between these two old camps. The gravel in this region represents remnants of Tertiary river deposits. In the western part of the county, near Ione, are accumulations of delta and shore gravel, deposited when the inland sea or gulf had its shores in that vicinity, during the time of the Ione deposition, which was at the same time as the formation of prevolcanic channels in the rivers of the Sierra Nevada. In places where it has been reconcentrated by later streams some of it has been rich enough to mine profitably. There are also beds of white and red sandstone in the Ione formation, which have been worked in the past. Marble occurs two miles east of Plymouth and eight miles east of Sutter Creek, enclosed in the Calaveras formation. Besides the numerous small bodies of limestone, there are two especially large areas, one at Volcano and one four miles northwest of that town. Asbestos, talc, ocher and low grade iron ores also occur.

Foreword.

As a part of the work of the Bureau, the people of the state in general and those who come here to invest their money in mining have a right to expect in our reports definite information as to results actually obtained in mining. The only way this can be satisfactorily given is to publish details of the results of actual mining operations, rather than to deal in generalities. The prospective operator wants to know the average grade of ore which he may reasonably expect to find in a given district, the size of orebodies and character of ores, and the average operating costs. The more complete and comprehensive such data are the better, as his proposed venture then contains fewer factors of uncertainty and approaches the ideal so nearly realized in the gold dredging industry, which has in recent years taken on the aspect of an attractive manufacturing project. The general public, too, advances for mining much larger sums than is realized. Such people as a rule can participate in mining only by buying stock in those companies which are financed by large numbers of small subscriptions. If the State Mining Bureau can make available to them exact information as to what has been and is being done in the industry, with a proper conception of the accompanying conditions, it has more than justified its existence.

The reports herein on many of the principal mines of Amador County have been prepared with these aims in view. The gold mining industry is entirely noncompetitive, and no conceivable injury to the interests of operators can result from publishing such information as appears.

Acknowledgment.

The writer wishes to acknowledge with thanks the assistance given by most of the important mining companies and particularly by Argonaut Mining Company, N. S. Kelsey and Harry Sheaf, its general managers at different times; Bunker Hill Mining Company, Central

Eureka Mining Company and its superintendent, Albion S. Howe; Old Eureka Mining Company, Moore Mining Company, Plymouth Consolidated Mining Company and W. J. Loring.

ASBESTOS.

On the *Mace Ranch* in the N.E. ¼ Sec. 20, T. 6 N., R. 10 E., 2½ miles northeast of Ione, asbestos occurs in irregular veins along the contact of serpentine and amphibolite. According to a field report by C. A. Waring,[1] this asbestos is of the amphibole variety and some of it is 12 inches long, occurring as slip fiber with some cross fiber. He described it as low-grade, siliceous and in small amount, as shown in the limited open cut prospecting work. Idle.

The occurrence of some chrysotile asbestos in the serpentine on this property is mentioned also in Bulletin 38.

The Mace Company, Ione, owner.

CHROMITE.

Like all the other counties east of the Sacramento Valley, Amador County was a producer of chromite during the late war, and a little ore was produced also in 1909. The yearly output was small, amounting to 585 tons in 1916, 65 tons in 1917 and 88 tons in 1918. There is no record of any chromite being sold in recent years.

The following properties were listed in Bulletin 76:

Name	*Location* Sec.	Twp.	Range	*Shipping Point*
Carr & Mefford	34	6	10	A. C. R. R. 2 mi. haul
Courtwright	2	5	10	Ranlett, 2½ miles
Detert Ranch	6	7	10	Carbondale, 8 miles
Dooley	Near Wait's			Carbondale, 6 miles
Wait	29	7	10	Carbondale, 6 miles

CLAY.

Clay of different colors and grades is produced in large quantity from numerous pits in the vicinity of Ione and Carbondale. One plant for the manufacture of fire brick has been in operation for many years. A clay-washing plant has lately been built. The clay is shipped to nearly every pottery and brick making plant in the state, entering into a great variety of products.

The clay occurs as a part of the Ione (Tertiary) beds and is distributed over a length of 12 miles and a width of 4½ miles in this county, but extends both northwest into Sacramento County and southeast into Calaveras. For the most part it is covered only by a soil and sand overburden, varying from a few inches up to a maximum of 20 feet. In a few places, as southeast of Buena Vista, it is overlain by tuff, breccia, and sandstone. It lies nearly flat, having a westerly dip of only a few degrees. The beds have been drilled in several places, and while the series is not uniform in either thickness or character, there is an ample supply. Lignite coal is interbedded with the clay, lying usually at a depth of 80 to 125 feet, where it has been worked or drilled, but in places at 40 feet or less. This lignite would probably mark the limit of clay mining in any event.

[1] Formerly Field Assistant, State Mining Bureau.

The white clay apparently came from the rhyolite ash flows, which have been found directly over the older series of gold-bearing gravel channels in the Sierra Nevada. Probably a long enough period of erosion ensued after these initial ash outbursts to permit the carrying of the finer sized and lighter particles down the streams into the shore waters of the inland sea which then filled the Sacramento and San Joaquin valleys. Before the white ash was covered and preserved by later flows of darker colored breccia and ash, a large part of it was thus swept away.

That the clay is of rhyolitic origin, possibly mixed with the quartz sand from those mysterious earlier rivers whose remaining sections show such a remarkable amount of quartz cobbles, with scarcely any other rock, is substantiated by the analyses. The sandy clay carries about 70% silica, 20% alumina, 1¼% iron oxides, 0.3% CaO and 0.2% MgO. Other samples where the percentage of silica is less, contain 32% to 34% dry weight of alumina. The amount of calcium is typically low and it is erratically distributed, sometimes as gypsum seams. As the percentage of iron increases the clay becomes mottled red and yellow, but the usual color is white, cream or light blue.

During the war, when imports of Belgian sand were cut off, a plant was operated near Ione to wash and separate sand and kaolin. This plant was described and pictured in Preliminary Report No. 7. The sand was used to make sodium silicate and the kaolin for heavy hotel ware and fine pottery. Sand was also mined in the district and after washing in a plant at Antioch was used for glass making. These markets were lost when importation of foreign sand was resumed.

A new use for Amador County clay is in making cement. One of the large companies has recently bought clay land and is using the clay.

Bacon & Bacon. Mark J. Bacon, manager, Ione. This firm has expanded its operations and is the largest operator in the district. They do a general clay mining business, working some properties for the owners under contract and also shipping to numerous consumers from pits which they themselves own or lease.

The work begins early in April and extends through the dry season. Twenty-five men, two steam shovels and six trucks are employed. They operate two pits under contract for N. Clark & Sons, one at Clarksona and one near Carbondale, and a pit for Pacific Portland Cement Company near Carbondale. A red mottled clay used for tile is mined near Lane's spur, east of Ione. The Chocolate Pit and Bacon Blue Pit near Carbondale, and the Baker Hill, Yaru and Gage Pits near Lignite, are also worked, furnishing clay for a variety of uses. The average overburden is from two to ten feet, and the deepest 60 feet. Some of the pits have to be pumped at the first of the season. The steam shovels and trucks handle a large tonnage in a short time for some of the consumers. The Sand Pit, near Shepard spur, contains sand clay running 60% or more silica and is used for firebrick and art tile principally.

Barber Pit is on the Arroyo Seco grant, one mile east of Ione, and is served by a spur track of the Amador Central Railway. Barber mines the clay under contract for Mark J. Bacon, Ione.

The sandy white clay has been opened to a depth of about 20 feet and is overlain by six to ten feet of mottled red sandy clay carrying

modules of red iron oxide. (See photo.) The deposit is worked by a series of wide drifts, 12 to 14 feet high, leaving pillars, and a large amount of clay has been removed. No. 2 stumping powder is used for blasting. The clay is hauled in cars by a horse and dumped directly into the railroad cars, only a few feet outside the workings.

N. Clark & Sons Company own clay property near Clarksona and Carbondale. All clay at present is mined for them under contract by Bacon & Bacon. At Clarksona they have large clay storage sheds with a capacity of over 20,000 tons. Clay is hauled to the sheds during the dry season and stored. The sheds adjoin the railroad track, and clay can be loaded directly into box cars as needed at the plant in Alameda.

Clark Sand Pit. Owners, N. Clark & Sons Company, Alameda. This pit is 1.8 miles north of Carbondale railroad station.

Possibly five acres have been worked here, to depths varying from 12 to 25 feet. The deposit is white sand with comparatively little clay.



Barber Sand Pit, one mile east of Ione.

It is overlain by one to six feet of soil which contains a great deal of the impure, sandy, concretionary iron oxide characteristic of the soil covering so many of the deposits in the region. Most of the sand has been taken from open pits by hand or steam shovel, but in one place it was mined by wide drifts, high enough to permit a truck to be backed underground. The property was idle when visited April 18, 1927, and water was standing in some of the pits, which would have to be pumped. This property formerly belonged to the Steiger Terra Cotta and Pottery Company, and is in Secs. 20 and 28, T. 7 N., R. 9 E.

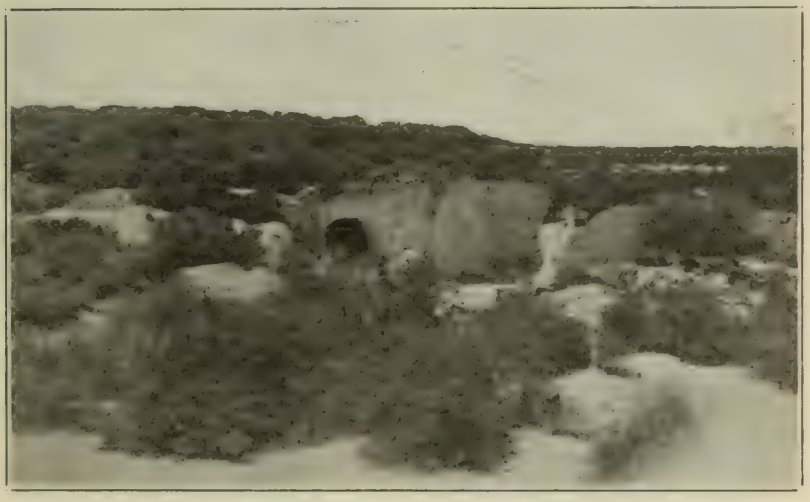
The company's clay pit is near the state highway and just north of Clarksona.

Carlile Clay and Sand Deposit. Owner, Mrs. Sarah E. Carlile, Ione. Lessee, E. E. Tremain, Buena Vista, via R. F. D., Ione. The property contains 60 acres in W½ of NW¼ Sec. 8, T. 5 N., R. 10 E., four miles from Ione and 2.8 miles by road to the nearest railroad spur. It is a new property, being opened for the first time.

Tremain is erecting a plant (Feb., 1927) to wash the sand and clay. A bed of white sandy clay, overlain by two to seven feet of brown clay, has been stripped over an area about 80 feet square. According to present plans, the clay will be dug by drag-line scraper. The washing and settling plant comprises several hundred feet of sluices with sand



Carlile Property, near Buena Vista, showing plant being erected by E. E. Tremain for washing clay.



Clark Sand Deposit, about two miles north of Carbondale.

traps and eight large clay settling tanks. The sand is expected to settle out on the way through the sluices and traps, leaving the clay in suspension, free from grit, to pass to the settling tanks, from which it will be drawn, filtered and dried. The estimated capacity is 10 tons a day. The sand is not at present being considered for marketing.

Harvey Pit. Pacific Portland Cement Company Consolidated, Pacific Building, San Francisco, owner. This is part of over 1000 acres of land recently purchased from Fred Harvey. The pit is just east of the old Harvey coal mine, and one mile north of Carbondale station. The land is in Secs. 32, 33 et al., T. 7 N., R. 9 E.

Blue clay occurs with an overburden of from two to three feet of soil in which are found occasional concretionary boulders of red iron oxide. The overburden is removed by plowing and scraping, using a tractor for power. The clay has been dug to a depth of about 12 feet by a small steam shovel. This loads the clay into trucks which deliver it to the railroad.

This clay contains about 32% alumina (dry weight) and is being used in the manufacture of cement. It is also used in making sewer pipe and terra cotta.

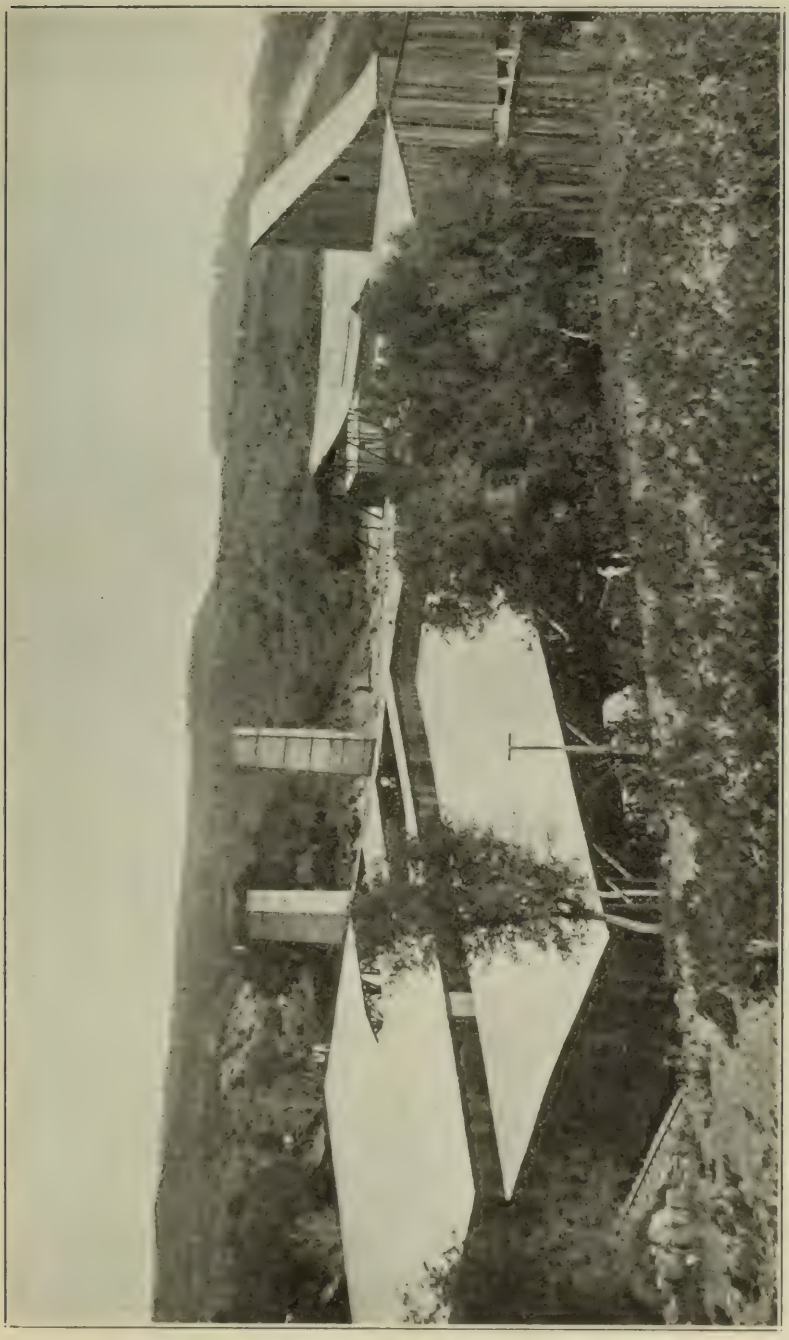


Harvey Clay Pit of Pacific Portland Cement Company, near Carbondale.

Ione Fire Brick Company. Main office, Rialto Building, San Francisco. Wm. Brown, Ione, superintendent. The plant is 1½ miles east of Ione, on the Amador Central Railway.

There are five round kilns, each 30 feet in diameter, down draft, with a capacity of 65,000 to 70,000 bricks each. Crude oil is used for fuel. It is atomized by compressed air, furnished by an electrically driven centrifugal compressor, furnishing just sufficient pressure for atomizing.

Clay is obtained in part from Lincoln, Placer County, and in part from a pit one mile from the plant near Shepards and from a 'grog' pit near Bacon's mottled clay pit, on the Jackson highway. The Lincoln clay is said to carry a little more silica and to show less shrinkage than local clay. The 'grog' pit also has a high silica content, as this deposit is quartz sand and gravel. The company works two men in each of the local pits. Clay is brought to the plant in railroad cars over an elevated spur track and dumped on a concrete floor from which a new belt conveyor being built will deliver it to the dry pan for



Plant of Ione Fire Brick Company, one mile east of Ione.



New Clay Pit, May E. Newman Estate, near Ione.

grinding. Clay is then raised to bins by bucket elevator, and fed thence to the pug mill, brick machine, cutting table and brick presses. The brick-making machinery has a capacity of 23,000 bricks a day (8 hours).

Bricks are burned eight days, of which time five days are required for gradual heating to the maximum temperature, cone 12, or 2496° F., which is held for three days. Two Elwell-Parker electric trucks, run by storage batteries and having a lifting capacity of two tons each, are used for handling brick. The product is shipped throughout the west, being used largely for locomotive fire-boxes, which put a severe test on firebrick, because of the extremes met with on mountain traffic. The plant works only in the dry season and employs 18 men.

Lane Mottled Clay Pit is near Lane's spur, on the Amador Central Railroad, a mile and a half east of Ione. Bacon & Bacon lease and operate it.

A loam overburden of one to three feet is stripped by hand. A row of flat holes six feet deep and five to six feet apart is bored along the bottom of the bank, which is 10 to 25 feet high, and the bank caves when these holes are blasted. The clay is then loaded by hand into trucks and hauled about one-fourth mile to the railroad. A large tonnage of this clay was shipped for use in tiling in 1926. There is said to be 20 feet of the same clay below the bottom of the pit.

Livermore Fire Brick Company has worked for some years a pit on the J. M. Fancher ranch, five miles south of the Amador Central Railway, and southeast of Ione. The clay is hauled in small trucks to a platform reached by an inclined driveway. The trucks dump from this directly into the cars on the railroad spur.

May E. Newman Estate. Main office, 980 Bush Street, San Francisco. C. W. Forbes, superintendent at the pit, Ione. This is the property formerly operated by J. Newman as the Newman Clay Company. It is one mile east of Ione and the main line of the Amador Central Railway passes within a few feet of the pits.

The old pits, operated for years south of the track, have been worked up to the property line. A new pit has recently been started on the north side of the track. In vertical section, so far as opened, it shows from top to bottom 25 feet of overburden, 10 feet of red mottled clay and 15 feet of white sand. The red mottled clay now being shipped for testing (April 18) is said to carry a little more sand than the Bacon mottled clay. Nine men were employed on that date. Clay is mined by hand in an open pit and hauled in a small truck to the railroad cars, a few hundred feet away. It is thought this clay will prove suitable for tile. The white sand is stated to run about 71% silica. If regular production starts, drifts will be run to avoid handling the overburden.

Stockton Fire Brick Company, Stockton, has for years obtained fire clay from a pit one mile south of Clarksona on the Southern Pacific Railroad, their shipping point being only a short distance west of Clarksona.

The deposit was opened originally as an open cut on the southeast side of a hill, but more recently has been worked by drifting to avoid

handling the rapidly increasing overburden, as the work advances into the hill. A vertical section shows the following formations:

3 feet soil and andesite boulders, increasing uphill
10 feet white and iron stained sand and sandy clay
10–14 feet white fire clay
red clay

The property was idle when visited in April.



Yaru Clay Pit, near Carbondale.



Clay Storage and Loading Sheds of N. Clark & Sons Company, at Clarksona.

Yaru Clay Pit is at Lignite spur, a short distance east of Carbondale. It is within the Arroyo Seco Rancho and is operated by Bacon & Bacon under lease. Four men and a small truck were employed in April, 1927, when visited.

An overburden of four to six feet of soil and sand is removed by hand labor. The upper clay bed is second quality clay, stained yellow,

and is about nine feet thick. A black layer a few inches thick seperates this from the better quality, which is light gray. This lower bed is 16 to 17 feet thick and is used for light-colored tile and fancy products.

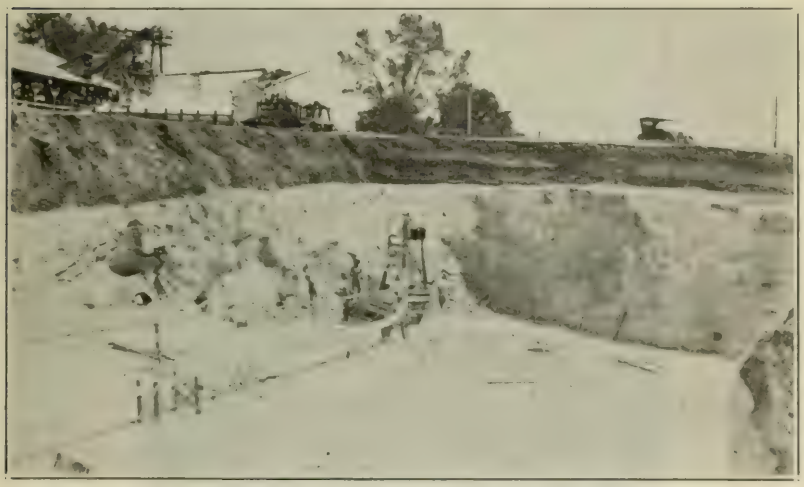
This deposit has been drilled to a depth of 90 feet, where lignite was struck. A sand bed containing considerable iron was struck between the clay and lignite.

The clay is dug and loaded by hand and hauled about 100 yards to a drying shed beside the railroad track. From there it is loaded on the cars with wheelbarrow, usually after aging several months.

CHANGES SINCE FORMER REPORTS.

The following changes have occurred as regards companies in the Amador clay industry, listed in our Preliminary Report 7, of January, 1920, and the Nineteenth Report of the State Mineralogist, 1923:

Amador Kaolin Company. Out of existence.



W. D. Amick White Sand Deposit, near Ione, Amador County. (The plant shown has not been in commission for several years.)

W. D. Amick Property (formerly operated by Philadelphia Quartz Co.). Idle. This deposit is one-half mile from Ione and is essentially a white sand deposit, with 70% to 80% sand and 20% to 30% kaolin.

The last operators worked it in an open pit (see photo). The overburden was stripped and the sand shot from the bottom and caved. It was then shoveled into a beater where it was ground to a freely flowing pulp and pumped to drag classifiers, which pulled out the sand. The clay in suspension in water passed through 1000 feet of sluices with a grade of one inch in 80 feet, and was caught in six redwood tanks, and finally passed to six larger tanks for settling. From the tanks the product was pumped to filter presses and the filter-cake was sun-dried, ground and sacked. The sand was freed of heavy black minerals by running it over James ore concentrators, which gave a final product carrying 98% silica. This was used in making sodium silicate. The washed kaolin contained just sufficient iron to burn a light straw color,

and was used for fancy pottery and heavy hotel ware. These operations ceased when imports of the cheaper Belgian sand were resumed after the war.

McKissick Cattle Company. Former owner of Rancho Arroyo Seco, a grant of 33,000 acres on which occur many of the clay and sand deposits described, *ante*. These deposits are being operated by Bacon & Bacon, under lease held by G. A. Starkweather.

Newman Clay Company. Now *May E. Newman Estate.*



Clay Storage and Loading Sheds, at Carbondale, used in Bacon operations in that vicinity.

Philadelphia Quartz Company. Has withdrawn from the county as a producer.

COAL.

Lignite was first exploited in Amador County as early as 1871, according to Goodyear. From then until 15 years ago production continued irregularly. Since that time oil for fuel, and electric power, have replaced coal to such an extent that there has been practically no lignite production. The demand for crude oil and its products is now so great, without assurance of development of new fields adequate to keep pace with the increase, that attention is turning to the possi-

bilities of domestic lignite. While there are large deposits of black lignite in other counties, the brown lignite beds of Amador County are not only extensive, but also conveniently located, with a broad gauge railroad crossing the deposits. As it is centrally located, as regards population, this district is in a position to benefit first from the utilization of such coal.

The possibilities of the Amador lignite include the making of briquettes, the preparation of powdered fuel or amalgam and the distillation of oil and its products. The beds lie generally within 125 feet of the surface and mining is cheap, so that if the lignite would stand transportation without crumbling it could compete successfully with any coal now brought into California for fuel purposes, as far as comparative costs and fuel value are concerned. In a report[1] on 'Gas Making and Fuel Problems of the Gas Industry of California,' Wm. W. Odell, Fuel Engineer, states his conclusion that "the coals of California are not well adapted for use in gas-making processes now in common use," and cites the sulphur and ash content as impediments. His report was the result of cooperation between the U. S. Bureau of Mines and the California Gas Research Council, an incorporated association supported by California gas companies.

The line of most promise for future development of these deposits, so far as experiments show, lies in the direction of making briquettes from the previously carbonized and treated lignite. The domestic market, where outside coal is now retailing for $17 a ton in winter, includes Sacramento and Stockton, both within 50 miles of the mines and having a combined total population of over 150,000, and adjacent parts of the Sacramento and San Joaquin valleys. The coal now in the market is not of high quality considering the price, but is cheaper than wood, so an opportunity for competition is indicated. At one time, many years ago, a briquette plant was operated for a short time near Ione by the Lignite Fuel Company. There is no record of why this suspended, but a few of the briquettes have been preserved as specimens. They have retained their original shape, are quite hard and compact, and do not crumble or soil the hands. They are said to have been made from the crude lignite without binder. The total production of coal from Amador County has been between 250,000 and 300,000 tons, practically all previous to 1902.

The lignite occurs as nearly flat beds in the Ione (Tertiary) strata. It dips west a few degree in places where drilled, and elsewhere occurs in the shape of flat saucers or lenses. It was probably deposited in a chain of marshy lakes stretching across the county from Lancha Plana to the county line northwest of Carbondale. The vicinity of Ione was along the ancient shore in those times, and the various sand and clay beds were erratically deposited, so that sections taken through the formations at different points would not be uniform. The Ione beds are made up of clay, sand and various gradations between the two. While white, sandy clay is characteristic, there is also much loose sand and grey and red mottled clay, stained by iron oxide. The brown lignite as it stands in the mine has a somewhat waxy appearance and is solid and homogeneous, containing considerable water. On drying at the surface it checks and breaks and loses weight. The vestiges of woody texture

[1] U. S. Dept. of Commerce, Bureau of Mines, Report of Investigations, Serial No. 2769, Sept., 1926.

and the bark, apparently of coniferous trees, are often evident. Lumps, probably of ionite, a brownish yellow, earthy hydrocarbon, occur in it occasionally, especially at the Buena Vista Coal Mine. The ionite burns freely when lighted with a match.

Buena Vista Coal Mine. Lessees with option to purchase, J. J. Morris and Darling Brothers, Buena Vista via Ione. The total holdings under lease are 75 acres from the Arroyo Seco Grant and 280 acres adjoining in the E½ Sec. 19, T. 5 N., R. 10 E., six miles from the nearest railroad spur east of Ione.

This mine was worked in 1913 by J. J. Fitzsimmons and some coal was sold locally. Since then, until 1924, it lay idle. The present lessees sank a new shaft a depth of 122 feet on an incline of about 45°.



Buena Vista Coal Mine, the only recently active lignite mine in Amador County.

This showed the following section when reduced to vertical equivalents, the vertical depth being 70½ feet:

50 feet—quartz sand
9½ feet—grey clay
1 foot—low grade coal
1 foot—clay
9 feet—good coal

The following drifts were open when the mine was visited in 1924 and 1926:

110 feet south in coal
95 feet east in coal to old shaft
90 feet west in coal from old shaft
35 feet north in coal from old shaft

An old drift 300 feet long in coal east of the old shaft, with coal blocked out 40 feet wide, was believed still open. There was also a drift west 100 feet from another old shaft, which lies north of the north drift and which was expected to be entered within 20 feet. A drill

hole 500 feet east of the new shaft was said to have shown coal 17 feet thick; 1000 feet south of this, a hole is reported as showing 20 feet of coal.

A few hundred tons of the lignite were mined and sold in 1925 and 1926. A hoist is operated by an automobile engine. There is a good storage building.

The following is an analysis of the Buena Vista coal, showing a high moisture content, even for this district:

Fixed carbon	39.8 %
Volatile hydrocarbons	22.75%
Ash	8.35%
Sulphur	0.90%
Moisture	28.00%

Tested after drying 10 hours at 105° C., this sample had an indicated heating value of 6366 calories.

Harvey Mine. Owner, Pacific Portland Cement Co. Cons., San Francisco. It is one mile north of Carbondale, the nearest railroad point, to which a spur track could be run with practically no grading.

The lignite has been partially developed by a vertical two-compartment shaft 88 feet deep, with drifts driven north and south in the nearly horizontal bed. The mine has been idle about ten years, and the workings during that time have been flooded and inaccessible, but the coal is said to have a maximum thickness of 20 feet, and the total length of drifts is reported to be 1000 feet. The material on the dump shows the form of fragments of trees from which the lignite was derived.

There is an old building housing a 60-h.p. steam boiler and hoist.

Mine No. 4 is one mile southeast of Carbondale, and one-fourth mile north of the Southern Pacific Company's railroad, with which it is connected by tram. It was formerly worked by the Ione Coal and Iron Company, being the last of a group of mines they operated. It was last worked in January, 1920. It is part of Rancho Arroyo Seco, a Spanish grant containing 33,000 acres, which is reported to belong to Stephen Kieffer, 57 Post Street, San Francisco.

A bed of brown lignite, seven feet thick, and lying nearly flat, has been opened by a vertical shaft 85 feet deep. Previous to 1920 it was worked by several thousand feet of drifts, leaving pillars. Coal was mined entirely by hand, and hoisted in cars on a cage, then sent down an incline to railroad cars. When last worked, 500 tons a month was produced and it was estimated that two years' reserve was left in the mine.

The above are only the latest worked of many lignite mines in the district. The numerous reports of the State Mining Bureau listed below contain descriptions of the different old workings. In the vicinity of Lancha Plana, which is just north of Mokelumne River, several small coal mines were worked during the '80s, but only a few tons were mined, due to the cost of getting it to market. The present owners of the land in this vicinity where coal occurs are *Penn Chemical Company* and *James Moore Estate* (John Moore, Stockton, W. D. and W. M. Amick, Mr. and Mrs. D. S. Mason, all of Ione).

In the Ione and Carbondale districts the only recent development has been the drilling carried on in 1923 under the direction of John Mocine on the Rancho Arroyo Seco. The holes showed that the lignite lies from 15 to 40 feet below the surface on the east near Lignite siding, and 3000 feet westward it is 81 feet deep. A number of holes indicated coal 21 to 30 feet thick, of which 12 feet are classed as 'heart coal,' of good quality. The deduction from this drilling was that either the ancient basins in which the lignite was deposited were larger than first thought, or that the lignite is now in the form of monoclinal strata. Previous government tests of the lignite, indicating a high oil content recoverable by destructive distillation, were reported by Mocine to have been substantiated in tests of his samples.

Analyses of Lignites from Amador County.

Property	*Volatile Hydrocarbons* %	*Fixed Carbon* %	*Ash* %	*Moisture* %
Mine No. 3[1]	49.00	27.75	10.50	13.25
Newman Ranch[1]	37.75	38.50	8.75	15.00
Mine No. 3[2] (4 samples)	33.35 to 42.4	11.85 to 34.3	9.25 to 47	7 to 14
Orr Mine[2] (Lancha Plana)	47.75	20.05	24.25	7.5
Wardell Mine[1] (Lancha Plana)	34.00	28.75	22.00	15.25
Buena Vista Mine[3]	22.75	39.8	8.35	28.00

Bibl: Cal. State Min. Bur. R. IV, p. 268; VI, p. 116; VII, p. 150; VIII, pp. 109, 113; IX, p. 323; XI, pp. 146, 148; XII, pp. 40, 65; XIII, p. 51; XIV, p. 11; XVII, p. 413. U. S. G. S. Folio Reprint 3, 5, 11. Min. Res. of U. S. West of Rocky Mtns. 1874, p. 43, R. W. Raymond.

COPPER.

There has been no renewal of activity at any of the old copper mines, which were described in Report XIV of the State Mineralogist, and in Bulletin 50.

Geologically the copper mines of the county are similar to the others in the foothill copper belt. They occur in the large area of amphibolite schist which traverses the county in a northwesterly direction, passing 2½ miles east of Ione and continuing into El Dorado County at Latrobe.

The most important of these mines were the *Copper Hill Mine* in the northwest corner of the county and the *Newton Mine*, four miles east of Ione. Both of these, and probably all of the small copper prospects in the county, were discovered in 1862 and 1863, during the state's first copper boom, and produced a few hundred tons of good ore before the boom collapsed in 1867.

Copper Hill Mine was developed by two principal shafts, one 500 feet deep and the other 144 feet deep, on parallel veins called the Oriental and Cosumnes, from which a distance of about 550 feet along the strike was explored by drifts. This property forms part of a large holding now devoted to stock-raising.

Newton Mine was worked to a depth of 430 feet and is said to have made a total production of 33,000 tons. During 1900, 3500 tons of 7 per cent ore was produced. This was the last production.

[1] Cal. State Mining Bureau R. XI, p. 147.
[2] Cal. State Mining Bureau R. XII, p. 65.
[3] Private analysis.

Bull Run Mine had a shaft 400 feet deep and was a small producer in the '60s. It is in Sec. 15, T. 5 N., R. 10 E., three miles east of Buena Vista.

The old *Ione Mine*, three miles north of Ione, has one shaft 600 feet deep and another 235 feet deep. Two short oreshoots of good grade were found and produced some ore reported to have yielded 7% copper, $8 gold, and some silver and zinc.

For the most part, the other prospects are now included in large holdings devoted to stock-raising. Notes on these are to be found in the reports mentioned in the first paragraph.

GEMS.

Mooney et al. Chrysoprase Claims. L. Mooney, Henry King, Wm. Yerington and F. R. Bequette, all of Ione, have located two claims for chrysoprase about six miles southeast of Ione.

The chrysoprase, of a bright green color, occurs as a seam an inch to 1½ inches wide in serpentine. It has been opened at intervals by shallow holes only, for about 400 feet. Samples of the stone so far found are perhaps seamed and laminated so much as to permit cutting only rather small pieces, but it may improve with depth. Idle.

Chrysoprase is a variety of chalcedony colored bright green by nickel.

GOLD (QUARTZ MINES).

The Mother Lode is one of the most interesting, and has so far proven to be the most persistent in depth of the gold-bearing formations of the United States. Of all the mines opened along the course of this lode, those of Amador County, taken as a group, have been the most productive. Opened on the dip of the vein to a depth of a mile, equivalent to 4500 feet vertically, they still carry profitable ore with most of the gold free, and without radical change in the nature of the orebodies. Increasing cost of operation, incidental to increasing depth, and the difficulty of holding the ground open, will eventually prove the factor limiting the operations, because that which is ore at shallow depth can no longer be handled at a profit even at the depths already reached in several of these mines.

The term Mother Lode has been loosely used and is associated in the minds of many people with a large territory, including indiscriminately all of the gold mines east and west of the main lode. While it may be true that most of the veins in this wider area are of about the same age, they cannot be grouped together because of wide differences in their characteristics. Strictly speaking, the Mother Lode in Amador County comprises the series of similar but not always continuous quartz veins in the comparatively narrow belt of Mariposa (Jurassic) black clay slate, the intensely altered igneous dikes or flows which are found in the slate, and the altered igneous rock originally andesite or diabase (but in many places adjacent to the lode changed to amphibolite schist by pressure), forming the immediate walls of the Mariposa slate.

The Mariposa slate was originally deposited in the form of mud on an ancient sea bottom and the occasional lenses of conglomerate indicate the old shore line. Volcanic tuff of the same age as the slate is often



A view of the Mother Lode, Amador County, showing, in foreground, the Bunker Hill Mine; in center, Treasure Mine, and in background, left, the headframe of the Fremont Mine.

found in it. The Calaveras (Carboniferous) schists sometimes are closely associated with the slate, and may be confused with it if the exposures seen are small, but are generally harder, more micaceous and vary in color. The Mariposa slate is the weakest rock of the region, lacking elastic strength entirely.

The principal component of earth forces in this region has been exerted in pressure at right angles to the axis of the Sierra Nevada, to which axis the strike of the schistosity of the slate is parallel. After the shale had been changed to slate, or while being so changed by the tremendous pressure, overturned folds were formed in many places and when these folds were broken the hanging wall portion was thrust up over the footwall, giving a reverse fault; a pre-mineral strike fault system was formed in this way which has determined the strike and dip of the Mother Lode veins. Oblique faults have cut across the lode in several places, dividing it into large blocks. There has probably been rotation within the blocks, with subsidence also on the hanging wall side, all facilitated by the formation of the blocks. It is not believed that this system of strike faults was reverse everywhere on the lode. Probably in places it was normal faulting. If not, the subsequent subsidence of the hanging wall in some mines has been enough to mask the previous movement. Movement northwest along the strike fault is indicated by the pitch of some oreshoots in that direction. Movement has continued at intervals over a long space of time, as shown by the occurrence of 'ribbon rock' on the footwall side of the vein, and by the cutting off of ore with low-grade 'drag' along the fissure. Some of the oblique faults have cut off ore.

Another consideration is of interest in connection with the location of oreshoots. When a soft, weak rock like the Mariposa slate is subjected to great pressure and movement occurs, the result is a finely ground, putty-like mass of gouge. This forms a natural dam in the fissure, and is relatively impervious to solution by the vein-forming fluids. There is little mineral deposited in such places unless there has been repeated opening of the fissure and intense action such as might occur with cross faulting. But where the fissuring has passed alongside or through a harder rock like the meta-andesite or amphibolite schist, and the inequalities and movement leave open spaces, these harder rocks will support an open cavity in which ore may be deposited. The harder wall rock and the quartz vein that grow up beside it are much more resistant to erosion than the soft, crushed slate. Hard walls, close together, will confine the auriferous solution to a narrow path, resulting in the deposition of richer ore. These considerations will explain why the oreshoots so often occur with a 'greenstone' dike for one wall or nearby in the hanging wall, and why the high land along the lode is commonly said to be most favorable for an oreshoot. The association of the vein and the hard rock is seen to be due to mechanical reasons. The gold came no doubt from a much deeper seated source, probably the underlying granodiorite. The carbon in the slate has probably been an active precipitant of the gold.

'Caunter' veins, occupying some of the earlier oblique faults, cross the lode and at times important and rich orebodies were formed at their intersections with the main fissure. The quartz forming the ribbon rock along the footwall side of the vein is generally richer, showing



Argonaut Mine and Mill, near Jackson, Amador County

of the ancient rock-forming minerals to dissolve the latter was the other as might be expected.

South of the Mother Lode, where the soluble minerals of the amphibolite rocks were taken in solution and deposited, gold-bearing quartz was deposited in their place. Although some vein with ore was found to be small in the form of pockets, the ore is generally lower grade than the quartz veins in the slate.

Quartz is the principal gangue mineral of the veins in the slate. The gold forms 50% or more of that recovered from these veins. The remaining value is composed of the gold carried with sulphides, composed almost entirely of pyrite, with galena as a characteristic of high-grade ore. In several mines small, rich shoots carrying arsenopyrite have been found, and chalcopyrite has been obtained. Tellurides in small quantity have been found. In this kind of ore the sulphides form 10% to 25% of the ore and range in value from $30 to $70 a ton. In the siliceous ore the sulphides form 3% to 5% of the ore and carry 5 cents of the gold.

Argonaut Mine.

History. Work began on this property in 1850, but was prosecuted on a small scale and in a desultory way until 1886, under the name of the Pioneer Mine. This mine was usually thought to end at the northern end of the Pioneer claim. While the Kennedy was being actively worked the Pioneer lay almost undeveloped for many years, and is said to have been offered to the Kennedy owners several times at the nominal price of $10,000. They evidently did not consider it worth the price. In 1887 an inclined shaft was started. When this had reached a depth of 175ft but work was stopped in 1889 by an injunction issued during a suit started by the Argonaut company against the Kennedy. The Argonaut owners were forced to prove their vein continued through to the apex in their own ground. As the shaft was not on the vein, they were obliged to complete raises the entire distance and after this having proved their apex, they were awarded heavy damages against the Kennedy. The Argonaut also successfully contested a suit of a later date with the Kennedy Extension Mining Company, on the south.

The Argonaut continued operations thereafter until the spring of 1922, when fire thought to have been of incendiary origin was discovered on the 4900-ft. level. In this period the mine workings had reached an inclined depth of 4850 ft., on an incline of 63°. The property between 1914 and 1922 had been producing the best average grade of ore of any mine along the Mother Lode, the mill-heads having ranged from $8 to $22 a ton. Within a short time the fire was thought to have been surrounded and brought under control, and work was resumed. But early in March, 1922, fire was discovered on the 3300-ft. level of the adjoining Kennedy Mine, having presumably eaten its way through old workings and caved ground. On March 17, 1920, the Kennedy management began filling that mine with water, and as the two mines were connected, the lower levels of both were flooded and the water rose to within 50 feet of the 1150-ft. level of the Argonaut. Unwatering began at the Argonaut early that summer, but they found the heat too much for their plant above and the Kennedy joined in the

work, which was completed in April, 1921, and 20 stamps of the Argonaut mill were started that month. By the end of 1921 operations were in full blast.

The mill-heads in January and February, 1920, had been probably higher grade than for many years past, and although there was a dropping off in the general average of ore after this reopening, the work was going ahead under encouraging circumstances on the 4800-ft. level and the 60-stamp mill was being operated, when on August 27, 1922, at 11.30 p.m., a fire was discovered at about 3350 feet in depth by a party going up on the skip. A shift of 47 men at work on the 4650- and 4800-ft. levels was trapped and before they could be brought out the shaft was on fire and all of them were lost.

The mine was not completely cleared and ready for operation again until July, 1923. It has remained in steady operation since. The shaft has reached an inclined depth of 5350 feet (4672 feet vertical). Stoping has lately been going on from the 4950- and 5100-ft. levels and the 5250-ft. level is being opened.

Production. Unlike most of the other well-known mines along the lode, the Argonaut (Pioneer) was not mentioned in the early reports, and its deeper development came only at a comparatively recent date. Argonaut Mining Company reports that the total production of the mine to the end of 1926 has been $12,400,000. This bureau's record of the tonnage of ore milled goes back only to the beginning of 1913. Since that time a total of 914,466 tons has yielded $7,702,705. The bonanza period of the mine was between 1914 and 1920, when the ore was coming from the levels between 3400 and 4800 feet. Since 1921 the average grade of ore has been much lower than for the seven years preceding 1921, since which year most of the ore has come from levels between 4650 and 5150 feet inclined depth.

Geology. The geology of the upper one-third of the mine was described by W. H. Storms,[1] who called attention to the fact that the vein occupies a fissure apparently opened by a reverse fault in which the hanging wall had been thrust up about 125 feet, as indicated by the displacement of the Mariposa slate in the raise from the 470-ft. level to the old Pioneer adit. Here should be mentioned the contention raised by the Kennedy Extension Mining Company in their suit with the Argonaut company. About 1200 feet in depth on the Argonaut fissure, a vein branched into the hanging wall. The Kennedy Extension contended that this was the older vein, which had been displaced 700 feet by normal faulting as measured along the Argonaut fissure. The upper part of the vein to a depth of 290 feet is in the altered greenstone, which has been classified as diabase by H. W. Fairbanks[2] and as meta-andesite by the U. S. Geological Survey.[3]. This rock has been changed to amphibolite schist near the vein. The vein crossed a narrow belt of Mariposa slate about the 470-ft. level, and from there to about 2500 feet in depth was about on the contact, with Mariposa slate footwall and amphibolite schist hanging wall. For most of the remaining depth, the footwall country rock is hard gray schist, but with a casing of black slate between it and the vein and the hanging wall is Mariposa slate. Where seen on the 4800-ft. level, the slate casing on the footwall

[1] Cal. State Mining Bureau, Bulletin 18, pp. 56–60.
[2] Cal. State Mining Bureau, Bulletin 18, p. 17.
[3] U. S. Geological Survey, Mother Lode Folio, No. 63.

was 10 feet thick, but in places is 20 to 40 feet thick, varying with the weaving courses of the footwall contact and the strike of the vein. On the 4350-ft. level the vein strikes N. 18° W. and dips 63° northeast, with slips in both the walls about parallel to the strike of the vein, but those in the hanging wall slate dipping about 80° northeast. On the 4500-ft. level the footwall contact strikes N. 20° W. and dips northeast 60° to 63°. On the 4800-ft. level the shaft crosscut to the vein crosses a pronounced slip with hard, blocky gray schist on the hanging wall side and slate on the footwall. This slip is 125 feet east of the true footwall, strikes N. 30° W. and dips 75° northeast. The vein, close to the footwall, has the normal strike of about N. 18° W. and dips 60° northeast. To properly correlate the geology of the Argonaut and the neighboring Kennedy on the north, it should be remembered that the Argonaut has the main footwall vein only, while in the Kennedy the breaking away of an immense horse of rock led to the formation of a hanging wall vein also. Dikes of greenstone, entirely altered to schist, occur within the Mariposa slate and on certain levels, as a result, the immediate hanging wall is greenstone and the footwall slate, as on the 3700-ft. level.

On that level the fissure was seven to ten feet wide and was one-half filled with gouge. Between the 3600- and 4200-ft. levels, because of its north pitch, the north oreshoot was in the Kennedy, then returned to the Argonaut. On the 4200-ft. level the vein was 20 feet wide; on the 4350-ft. level it was 30 feet wide, and continued wide in the south drifts in the deeper levels. Though most of the earth movements have resulted in crushing the slate, the footwall schist is in places shattered, and traversed by numerous quartz veinlets and occasional slips about parallel to the main vein, the schist being reduced nearly to gouge along these slips. The complete tracing out of the faults in this or any of the other large mines on the lode would require careful study at frequent periods over a number of years as the development work went on. Besides the pre-mineral strike fault of the lode, and the accompanying slips, there has been an important oblique fault in the Argonaut property, and post-mineral faulting within the vein. The 4500-ft. north drift 150 feet south of the Kennedy line showed the vein 15 feet wide with a width of six feet next the hanging wall dragged down. On the south on many levels the ore had been bounded by the oblique fault mentioned. This strikes northwest and its trace on the plane of the vein dips 70° to 75° northeast, judging from the positions where it was encountered on many levels. On the 4500-ft. level, about 200 feet south of the shaft crosscut, there was a length of about 200 feet of broken and crushed ground as a result of this fault. On the 4650-ft. level, the vein was stoped 480 feet in length when the crushed ground was encountered. This extended for 75 feet, and ore was found south of it, showing, when visited, 25 feet of quartz of which the hanging wall part was solid white quartz, with the best ore consisting of a few feet of ribbon rock on the footwall side. On the 4800-ft. level the vein widened rapidly south of the region where the fault had been found on the levels above. From a width of a few feet on the north, the vein increased in width to 60 feet on the south, and there was stoped 30 to 60 feet wide. The stope length on this level was over 1000 feet. On the 4950- and 5100-ft. levels the vein is reported much

narrower, and the oreshoot has apparently shortened and become flatter, approaching the shaft, which is in the hanging wall of the vein. The manager reports also a lower average grade of ore and ground increasingly hard to hold open, resulting in an operating loss in 1926.

Formerly, the mine was worked with a square set timbering system in the wider parts of the vein and stulls in narrower places. Since Harry Sheafe became manager, modified vertical slicing has been installed, following experience with caves on the 4500-ft. level. The method consists of driving a double-compartment raise in ore between levels. From one side of the raise, starting from the upper level, a stope is started by carrying down a vertical slice, dropping ore through one compartment of raise. The horizontal stulls are supported by booms of 10-inch by 12-inch timber, 16 feet long, extending out from the raise, and the timbering of successive sets is completed by the addition of posts as the slice is carried down. When a pair of slices, each about five feet along the strike, have been carried clear through they become the working compartments, replacing the original raise, which can then be stripped and filled.

Ore and Milling. The ore has remained free-milling at the great depth reached. It contains about 2½% of sulphides, of which pyrite forms the larger part. The concentrate contains about 16% of the gold recovered and runs about $100 per ton in value for the higher grade ore. Generally speaking, the best ore is within a few feet of the footwall, and is of a ribboned structure which indicates repeated reopening movements and filling along that wall. Specimen rock is found at times. Milling is done in a 60-stamp mill which has been crushing an average of 250 tons a day during the past three years, in spite of the difficulty of doing all work at such a depth with one hoist and one shaft. After stamping, coarse and medium pulp is concentrated on Deister tables, the balance passing to Dorr classifier from which the fines (overflow) goes to Frue vanners. The underflow (coarse) is reground and sent over the Deister and Frue vanners. All tailing and concentrate are cyanided by Amador Metals Reduction Company.

Round pine timbers are supplied from the eastern part of the county, a short truck haul distant. Square 'Oregon pine' pieces for shaft sets, etc., are brought from Oregon. Electric power is used throughout. About 200 men are employed (March, 1927).

Argonaut Cons. Mining Company controls Argonaut Mining Company, the local operating company, and is in turn controlled by White Knob Copper and Development Co. of New York. The first named paid dividends during the war period up to 1922. Argonaut Mining Company resumed dividends in 1925 when the 106th was declared, but passed their last dividend. Much of the profit that might have been realized in recent years was diverted to pay the expense of twice unwatering the lower workings and repairing them and the shaft after the fires. The company has made a good fight during the past seven years in the face of many adverse circumstances. During that time this and three others of the principal producing quartz mines have stood the brunt of the county tax burden and have been the principal sources of livelihood for the workmen and merchants of the county.

The mine's production has been entirely from the Pioneer claim, and prospecting work done in the attempt to open ore elsewhere than in the main footwall vein has been reported unsuccessful.

Bunker Hill Mine was found in 1851 and was worked intermittently until 1899, then continuously by Bunker Hill Consolidated Mining Company until late in 1922. This mine was noted for many years as a profitable producer, in spite of the low average grade of ore. During a period of 11 years, prior to September, 1916, it paid 123 dividends. The gross production was about $5,000,000 and the total dividends between $900,000 and $1,000,000. At the time distribution of profits ceased the ore being mined was averaging about $4 a ton. Costs kept increasing to such an extent that what was first an operation without profit, carried on for the sake of keeping the mine in shape, turned into a loss, and it became necessary to search for ore of better grade. From May, 1917, to February, 1920, mill operation was at half capacity or less and from then until the property passed to the new owner in 1922, little milling was done and most attention was given to a search for new orebodies in the black slate, but these were not found.

The mine was worked through a shaft 2800 feet deep, giving a vertical depth of 2382 feet, and from that level 1020 feet north of the shaft a winze 640 feet deep on an angle of 53° was sunk during the later prospecting operations, giving an additional vertical depth of 511 feet. The shaft is concreted for 240 feet below the surface. Levels were run at inclined depths of 200, 300, 400, 500, 600, 800, 1200, 1400, 1550, 1750, 1950, 2200, 2400, 2600, 2800, 3200 and 3400 feet. The shaft is about 550 feet north of the south end-line, and work in both directions has been carried far enough to connect with adjoining mines, the Treasure on the north and the old shallow Mayflower shaft (belonging to the Bunker Hill now) on the south. The greatest distances drifted north were 1750 feet on the 2400-ft. level and 1778 feet on the 2600-ft. level. To the south they drifted 550 feet. Numerous crosscuts were run. On the 2800-ft. level they also ran a crosscut 400 feet west to the contact.

The principal operations at this mine, as at most of those on the lode, were on orebodies in the black Mariposa slate at the meta-andesite contact, known here as the hanging wall vein. The footwall of this vein was the soft, swelling slate, and hanging wall greenstone (meta-andesite) although the wall rocks were in places both slate, or the footwall greenstone. The work between the 1950-ft. and 2800-ft. levels is on the hanging wall vein, and this same vein was being prospected in the winze workings below 2800 feet, where the hanging wall is hard meta-andesite, in places altered to amphibolitic schist. The ore in this vein is a black gouge ore with quartz stringers. This vein was stoped above the 2400-ft. level, where the orebody was of a maximum length of 800 feet and a maximum width of 10 feet, averaging five to six feet. There is still considerable low-grade ore left above the 2800-ft. level.

When the slate ore in upper levels was stoped out, the 'grey orebody' was found on the 1400-ft. level and was worked down to 1950-ft. level, but has not been prospected below. Where first found, it was 40 feet west of and about parallel to the Bunker Hill vein. It had a maximum length of 850 feet and average width of 30 feet, but was in places 125 feet wide. This ore was formed by the hydrothermal alteration of the

schist which had been derived from the andesite. The andesite occurs here, as at other mines in the district, in the forms of lenses, as well as in the large masses on either wall. At its northern end, this orebody entered the hanging-wall fissure. The schist ore was characterized by 2% to 4% of sulphides, mostly pyrite, which carries most of the gold. It differs from the slate ore, where most of the gold is free.

The mill contains forty 1050-lb. stamps, dropping 96 times a minute; 10 in. by 20 in. crusher, 5 Deister Overstrom tables, 24 six-ft. Frue vanners and a 5 ft. by 6 ft. ball mill for regrinding sand. The crusher required a 30-h.p. motor and the mill two 50-h.p. motors. After crushing with stamps and amalgamating free gold, the pulp was run over the Deister tables, giving the first concentrate, then sand was ground in the ball mill, amalgamated, and concentrate saved on the Frue vanners. The capacity is 200 tons a day. Tailing and concentrate were formerly cyanided. The concentrate averaged $50 a ton in value.



Central Eureka Mine, near Sutter Creek.

Total operating cost when 'normal' conditions prevailed, in 1914 and earlier, was $3.35 a ton. The grey ore, running about $5.70 a ton, allowed a good profit at that time. The ore developed in the hanging wall vein to date of closing would scarcely have paid even under former conditions.

Central Eureka Mine.

History. This mine was discovered in 1869, and was called the Summit. A 'chimney' of ore found at a depth of 165 feet yielded about $30,000, it is said. In 1871 there were two shafts, one 300 feet and the other 500 feet deep. One shaft finally reached 550 feet in depth and another 700 feet, when the company quit work. The mine lay idle thereafter until March, 1896, when Central Eureka Mining Company began operations.

The south shaft, 700 feet deep when the company started, was sunk to a depth of 1850 feet by the latter part of 1900, and a 10-stamp mill

was built. Writing in that year, W. H. Storms[1] stated that several short, narrow oreshoots were found at a depth of about 1000 feet, and that these increased in length and width until they formed one good-sized shoot in the bottom level. According to Storms, the vein as then revealed was "the most simple in geological structure of any extensively developed mine on the central lode. It consists practically of a single fissure cutting in strike and dip the black tufaceous slates and amphibolite schist which form its walls. The mine has certain peculiarities which are noticeably persistent. One of these is the firmness and regularity of the hanging wall. The wall is not absolutely straight in strike, but rolls more or less in a series of long swells. The gouge which is always found on the footwall side, also has a sinous course, swinging toward and away from the hanging wall. When at some distance from the hanging wall, little or no ore occurs in the fissure, but upon its approach to the hanging wall, the long, lenticular masses of quartz, which constitute these orebodies, begin to form."

However simple the geology of the old upper workings may have appeared at that time, the geological conditions have been far from simple in later years.

The company operated with a good profit up to 1907, paying large dividends. The operations during this period were on the hanging wall vein from 1000 feet to 2500 feet inclined depth, and a little ore was also taken from the intermediate vein.

After closing in 1907 the mine was reopened in July, 1908, and work continued until the spring of 1913, but was then interrupted again from April to the end of that year. In 1914 another loss of six months' time resulted from caves in the South Eureka shaft. During this period the mine was worked at a loss. The ore decreased in value to below $4 a ton and for some years averaged only a little over $3 a ton. The shaft in 1914 had reached a depth of 2825 feet. During the next five years it was sunk to a depth of 3500 feet (incline). Only low-grade ore was found during this time, and many assessments were levied. The retiring directors in April, 1916, concluded the mine was exhausted, and wanted to quit. Conditions at the time appeared to warrant this. For several years the oreshoots had been shortening and of low grade. The plant was getting old, the shaft was bad and the skip was still being run on strap iron. Due to the convergence of the end-lines in the direction of the dip, the length of the holdings along the contact vein was shortening on each successive level. But fortunately for all the stockholders, the new board of directors decided to continue. C. E. Julihn reported on the mine and advised that the east and west country be explored, as the former work had been done in the central part of the lode. The new program was begun that year. Work was partly financed during this period by assessments, the returns from milling being insufficient to pay the operating costs. Early in 1919 the 3500-ft. level was reached. The shaft crosscut on this level showed signs of ore. On the north also, a good shoot was struck and was stoped on to the 3425-ft. level. In the north drift, a winze was started and at a depth of 85 feet below the level a winze level was turned and was drifted both ways, in fine ore. Other encouraging prospects began to be found.

[1] Cal. State Mining Bureau, Bulletin 18, p. 64.

The stockholders had now reached their 48th assessment, but at this point the mine was entering its bonanza period, and during the years since 1919 has richly repaid their tenacious faith. In the year ended April 22, 1920, a total production of over $430,000 was made, the ore coming principally from the 3500-, 3600- and 3700-ft. levels, and averaging for the year $13.15 a ton, with an extraction of $12.40 a ton. Dividends began that year and have continued since. The lowest working level is at 4700 feet inclined depth or about 4360 feet vertical.

Geology. The lode belt at the Central Eureka is about 1600 feet wide, and is composed principally of Mariposa (Jurassic) black slate, in which occurs, in the westerly or footwall section, several dikes of andesite or andesite porphyry altered to schist. The series of rocks dips east at a somewhat steeper angle than at most places on the lode. Both walls of the lode are andesite (or diabase, as described by some authors). The veins so far found are in the westerly or footwall half of the lode. The principal vein worked in the earlier operations was the so-called hanging wall or east vein, which has an andesite dike for its immediate hanging wall. The oreshoot on this vein extended from about the 1000-ft. level to about the 2540-ft. level and apparently had its greatest stope length about the 1500-ft. level. It was one to twelve feet thick. Below 2540 feet in depth considerable stoping was done on the intermediate vein also. The upper part of the hanging wall oreshoot paid well, the ore averaging $7.16 a ton up to 1905. While the record is not available, this must have come from above the 2500-ft. level entirely. The section from there to 3400 feet in depth on all the veins was low grade. In 1907 the ore was worth $5.60 a ton, but still permitted dividends. From 1908 to 1919 apparently no dividends were paid. During this time the ore was in small scattered bunches and yielded an average of $3 to $4 a ton. The east vein was stoped from the 2500- to the 3000-ft. level. Stoping on the footwall vein started below the 2825-ft. level in 1914. On the intermediate vein, stoping was done between 2500 and 3200 feet. This oreshoot came in from the South Eureka line and pitched south, crossing the shaft at about the 3200-ft. level.

The shaft struck the hanging wall or east vein at 500 feet and followed it to about 2000 feet deep, where it passed into the slate in the footwall of that vein. It cut the intermediate vein below 2700 feet. About 25 feet below the 3425-ft. level the shaft entered the altered andesite and the 3500-ft. level and ore-pockets are in this rock.

Considerable prospecting was done both east and west of the shaft, especially after 1917. On the 700-ft. level an east crosscut was run 774 feet without finding ore. On the 1800-ft. level the footwall crosscut was run 717 feet through alternating slate and dikes, but no ore was found. Small lenses of good ore began to show in the footwall gouge on the 3350-ft. level. On the 3500-ft. level in 1919 a contact between slate and 'greenstone' (altered andesite) was struck 28 feet southwest of the shaft. They drifted south 215 feet along this contact, which carried two to five feet of rock and ore assaying $2 to $7 a ton, with some good assays. In this south drift a crosscut was run 30 feet west and cut three feet of fine ore. The main crosscut west from the shaft was in crushed slate and quartz stringers. At a point 33 feet west of

the 'greenstone' contact, in this crosscut, quartz showed on the north side and on being followed it proved to be a good oreshoot. From this north drift a crosscut northeast to the 'greenstone' contact failed to show ore, but about 30 feet farther north, another hanging wall crosscut struck a small oreshoot. It began to be realized that geological conditions were complex in the mine. It seemed unsafe to leave any block of ground unprospected, even when an apparently firm rock, with the appearance of a true wall, was reached. In the floor of the north drift on this level a winze was sunk and at a depth of 85 feet drifts were turned both ways. The first 50 feet on the north had an average width of 14 feet and assayed $20 a ton; for 80 feet on the south it was even better. The ore here was ribbon rock, carrying pyrophyllite. This ore had increased from a width of two feet or less on the 3425-ft. level to 21 feet on the winze level, about 160 feet deeper. The low-grade ore previously milled had carried nearly one-half of the gold in the sulphides, but this richer ore has had five-sixths, or more, of its gold in the free state. A little gold telluride has been found. The ore has continued good in the lower levels and the shoot continued to increase in size. On the south it was more bunchy than on the north. On the 3700-ft- level on the south the vein was crushed by a vertical fault along the plane of the vein, which here cuts through the 'greenstone,' with the latter west of the drift. At this level the hanging and footwall veins are close together.

It is not practicable to discuss fully the geology of the mine in this quarterly bulletin. For a proper understanding of it, the South, Central and Old Eureka mine workings and oreshoots should be illustrated. Due to the convergence of the end-lines of the Central Eureka or Summit claim, toward the east in the direction of the dip of the vein, and the question raised as to the exact identity of the vein in which the new oreshoots had been found, the company found itself in an embarrassing position in 1923. The length of vein between the end-lines of the Summit claim, produced easterly, was rapidly decreasing. Fortunately, they were able at that time to reach an agreement with the owners of the Old Eureka for the purchase of that property for $150,000. The contention of Albion S. Howe, superintendent of the Central Eureka, has been that the vein opened in the lower levels is not the same as that mined above 2540 feet, it being claimed that the vein in the old upper workings was a younger vein, which broke and faulted the older, and that the upper portion of the older vein lies to the east and outcrops on land controlled by the Central Eureka, although in the lower levels it is west of the east vein.

The footwall vein oreshoot on the 3760- and 3900-ft. levels is reported to have been 340 feet long and averaged nine to ten feet wide, filled with quartz ribbon rock and gouge. On the 3500-ft. level, ore had been in two shoots separated by 160 feet of low-grade filling, but in depth the south shoot pitched north and they joined. The ground had been stoped out on this oreshoot previous to April 1, 1926, down to the 4400-ft. level. When the writer visited the 4550-ft. level late in 1926 stoping was going on there, and the 4700-ft. level was being opened. On the 4550, a width of about 60 feet traversed by the shaft crosscut should probably be considered vein matter. North of this the vein is a stringer lead of crushed quartz and slate striking N. 40° W. and

dipping 71° E. and the orebody has an average pitch of 45° NW. in the plane of the vein. It is roughly wedge-shaped here, with the big end down. On the east side, a spur vein striking N. 25° W. makes into the vein at this oreshoot. This spur vein itself forms stoping ground for 165 feet near the junction. Above the drift on this, a very rich streak traverses the spur vein diagonally to the junction with the main vein. In cross section the following were seen: high grade quartz ore in black graphitic schist, probably a phase of an altered dike rock; on the hanging wall side of it, eight feet of quartz ore, and on the hanging wall side of this, the point of a 'greenstone' dike, 18 inches wide, separated from the ore by a small slaty gouge. On the east is more of the graphitic schist, which is a different rock than the Mariposa slate. The schistose andesite (amphibolite schist) appears nearby in the footwall. The high-grade quartz is finely crushed and may be rubbed to powder in the fingers. The whole vein is much disturbed and smashed. The high-grade streak enters the main vein about the center of 425 feet of stoping ground. The movements which crushed the quartz and slate are thought by Howe to have been a series of faults entering from the hanging wall side, as he says the footwall is unbroken, and all polished faces and slickensides are in the hanging wall portion of the vein. The high-grade occurs where the vein narrows. On the north and separated from the main orebody by 130 feet of blank ground, is a quartz orebody 80 to 100 feet long.

As greater depth is reached, the vein becomes more broken and crushed. This was noticed first on the south, but has reached the point on the 4550- and 4700-ft. levels where the slate is ground to gouge and the quartz to powder. Possibly this is due to an oblique fault of the same character as that described under the Argonaut.

Production. The total production by the present company from March, 1896, to April 1, 1927, was $6,602,952. For the year ended March 31, 1927, 46,756 tons of ore were milled, which yielded $551,108, or an average of $12.85 a ton. The upper oreshoots, worked between 1896 and 1907, inclusive, yielded 287,175 tons which returned a gross recovery of $1,911,358, or an average of $6.66 a ton, although the average grade was higher for the period prior to 1905. From 1908 until early in 1919, and between the 2540-ft. and 3425-ft. levels, the material milled was for the most part too low grade to pay expenses. From 1920 to 1926 over half of the total production has been made and the ore has averaged $10.58 a ton. The levels between 3425 and 4550 feet inclined depth have already yielded over 300,000 tons of ore.

Ore is crushed in a 40-stamp mill and concentrate is saved on Frue vanners. The mill showed an average capacity of 146 tons in 24 hours in 1924 and 152 tons in 1925. The recovery has ranged from 89.37% to 91.77%. Some loss is said to occur in fine, flaky telluride. The concentrate forms from 1.65% to 2.5% of the ore and ranges in value from $70 to $90 a ton. By far the greater part of the gold is recovered as bullion; only 14% to 20% of it is in the concentrate.

Many improvements have been made in the plant since 1920. The old strap-iron in the shaft has been replaced by 56-lb. rails and the shaft has been straightened and widened in places. A new steel headframe 85 feet high has been built, a powerful hoist has been installed, and electric power substituted for steam, the mill repaired and many

other changes made. The conversion to electric power, besides giving greatly increased depth capacity, is said to give a saving of from $1000 to $1500 a month in the cost of hoisting. The importance to the county of an enterprise like this mine is realized when it is remembered that about $200,000 was spent in 1925 for labor alone.



Headframe at Central Eureka Shaft, at Sutter Creek, showing skip runway in the form of a bridge truss.

Microscopic Studies and Analyses of the 'Greenstone.'

Through the courtesy of Albion S. Howe, superintendent, the following studies and analyses of the 'greenstone' (altered andesite) on the 3900-ft. level of the Central Eureka Mine have been made available:

Report and Analyses by Phillip B. Wilson, Chief Geologist, Calumet and Arizona Mining Company, Warren, Arizona.

"The specimen marked hanging wall greenstone is more accurately a hornblende andesite porphyry. It is the fresher of the two. Its analysis shows 47.5% silica, 17.5% alumina, 8.0% lime, 5.7% iron, 5.0% magnesia, which would place it as a very basic andesite.

"The footwall greenstone is so highly altered that only remnants of the original rock minerals can be seen with a glass. It is a mass of kaolin and chlorite, with a little sericite and calcite, all secondary alteration products of original feldspars and of the ferro-magnesian minerals, hornblende and biotite. It was probably an andesite before it was so thoroughly altered. It shows many tiny disseminated pyrite and chalcopyrite crystals. An analysis yielded 47.7% silica, 14.1% alumina, 5.9% lime, 4.8% iron and 5.0% magnesia."

Report by Professor C. F. Tolman, Leland Stanford, Jr., University.

"Minerals distinguished under the Microscope (hanging wall greenstone):

(1) Feldspar, both acid plagioclase and orthoclase.
(2) Quartz.
(3) A ground mass which has been altered into kaolin.
(4) Much pyrite, the result of hydrothermal alteration of the rock.
(5) Also small amounts of pyroxene, augite and magnetite.

"The hanging wall rock is strongly porphyritic and in the specimen shining phenocrysts of pyroxene are abundant. Under the microscope pyroxene and plagioclase are recognized. These occur in an opaque ground mass which originally was probably a glass and is now altered.

"Under the microscope the rocks are seen to both be varieties of andesite. The footwall rock is much finer grained and less porphyritic than the hanging wall rock. It is more silicic in character than the average andesite. It has the texture of either a flow rock or an intrusive rock, more likely an intrusive."

Cooper Mine. It is a mile and a half by road northeast of Oleta. It was worked to a depth of 270 feet years ago by Cooper, and is credited with having been a good pocket producer. Later the workings are reported to have been lost on account of insufficient timbering. Only short drifts were run.

Defender Mine. Owner, West Point Con. Mines, Inc. Leased in 1924 to R. C. Reed, Volcano. It is five miles southeast of Volcano, near the West Point road.

There are three veins in granodiorite. The Defender vein is the middle one of these and the only one on which much work has been done. The main shaft, reported to be 480 feet deep, is on this vein, which is said to have averaged 20 inches wide. Levels were run at 100, 200, 250 and 300 feet and a maximum distance of 665 feet is reported to have been drifted, on the 200-ft. level. This work was done years ago and there was no opportunity to check it, or to observe underground conditions, as this part of the mine has been idle and workings were inaccessible at times of visit. The oreshoot was stoped at least from 250 level to the surface, and the production from it is reported to have been $160,000. The oreshoot was reported wide on the 300 level, but only 100 feet long, and is said to be bounded by three dikes, one 100 feet north of shaft, another 80 feet south of shaft, and the third cutting the vein at 360 feet depth. In the lower workings the ore became so heavy with sulphides (principally pyrite), that it could not be treated, the sulphide content being too high for concentration, and the gold content about $10 a ton.

In 1924, Reed drove a short adit and sank a winze 50 feet deep on the west vein. The quartz in this winze was six feet wide at time of visit, with hard walls and no gouge, and a poorly defined footwall. What appeared to be a dike was exposed on the hanging wall. Reed

reported that 11 tons mined here paid $57 a ton. The ore of this mine, in common with that of the adjoining West Point district in Calaveras County, is complex, containing free gold and sulphides of iron, lead, zinc and copper.

Fremont and Gover Mines. The property covers 4200 feet along the Mother Lode, north of the Treasure Mine. There is little information available about the earliest history of the property. The claims in their order from north to south are: North Gover, Loyal Lode (east side), Gover and Fremont. The Loyal Lode had a 20-stamp mill in the '60s.

The Fremont and Gover were consolidated at an early date, and are described in early reports of this bureau, notably the Eighth, Tenth and Eleventh Reports, under the name of Gover Mine. The company was incorporated in 1872 and most of the early work was done on the Gover claim. Two shafts were sunk, of which the north one was the principal working shaft, and finally reached a depth 1500 feet (1050 feet vertical). Two veins were developed which were separated by a reef of black slate, sometimes only a gouge, but elsewhere 90 feet thick or more. Diabase, or schist derived from it, forms the hanging wall, as at neighboring mines. The contact vein, next to the diabase, produced the best ore mined. This ore was characterized by rich pockets of gold, and considerable arsenopyrite. At times the pocket stringers made into the diabase hanging wall. This shoot was about 200 feet long by 20 feet wide and pinched about 800 feet in depth, and a little deeper the slate receded, leaving the footwall vein on the contact for several hundred feet. Below this the East vein made into the hanging wall diabase. It was mineralized schist ore, had an average width of 30 feet and the low-grade oreshoot in it was nearly 300 feet long. This class of ore continued to the bottom. The lode in this mine was explored for 1100 feet south and 400 feet north of the shaft. At a distance of 1000 feet south of the shaft on the fourth level, the hanging wall fissure passed into the diabase of the hanging wall, and became a gouge seam. A drift on this soon struck a fault, which threw the formations west (looking south) evidently about 50 feet, the strike of the fault being a little north of east.

Early in 1900 the Fremont shaft was started. The mill was built in 1903. The upper levels, principally from 400 to 700 feet deep, developed the hanging wall slate vein and the pocket ledge, where rich stringers made into the diabase hanging wall. From the 800-ft. level downward the 'grey ore' or East vein of mineralized schist (derived from the diabase) was mined. Fremont Consolidated Mining Company worked until 1918 and reached an inclined depth of 2300 feet. The mine was closed in December of that year.

During that period a mill of forty 1000-lb. stamps and 16 Frue vanners was operated by the company, and the California Slimes Concentrating Company operated a canvas plant below the mill. The ore during the later operations was rather low grade, ranging around $5 a ton. The mine was opened to a depth of 2500 feet on an incline of 51° and was prospected for a maximum length of 2500 feet on the 1650-ft. level.

Late in 1920, *Metals Exploration Company* began unwatering the property and it was prospected during 1921 and 1922. Early in 1923

the mill was repaired and 20 stamps were put in operation. The 1650-ft. level was extended northward to a distance of 2500 feet and prospecting was done on several levels below there. The company continued work until August, 1923, when it quit. Edwin Higgins and Roy Elliott, who had been employed by the company, and S. A. Holman, Elliott Check and W. E. Colby formed a new stock company immediately to continue the work. The mill was operated for a short time, and an attempt was made to finance further development work by selling stock, but evidently this was unsuccessful, as operations terminated in February, 1924, since which date the mine has lain idle.

The mine was opened to a depth of 2950 feet on 51° incline, and the lower levels were called the 1950-, 2350-, 2550- and 2750-ft. levels. It was said to be costing the owning company about $5 a ton to mine and mill the ore, and it was nearly impossible to get labor when they quit in 1918. The 'schist ore' mined in the last operations was reported to carry from $4.56 to $7.50 gold a ton. Ore was claimed on the 16th, 19th and 25th levels in two separate oreshoots, one under the shaft and one 700 feet south of it. The south oreshoot on the 25th level was reported 125 feet long by 18 feet wide; on 23rd level, 160 feet long by 25 feet wide. The Fremont 'new orebody' had apexed on or near the 1500-ft. level on the contact of altered andesite hanging wall and slate footwall. It was 300 feet long by 12 feet in average width down to the 1650-ft. level and the millheads there are said to have averaged $5.25 a ton. The operations by the last two companies apparently resulted in the development of little new ore.

The mill handled an average of five tons per stamp or 200 tons per day during most of the time under the owners. An average recovery of 85% was made by amalgamation and concentration on Frue vanners and the canvas plant saved about one-third of the remainder. Tailing was stored on the property.

In the last work by lessees a fictitiously low operating cost was claimed because of mining and milling ore developed previously, without taking account of the cost of developing it. The capacity, with 35 stamps in use, was raised to 215 tons a day, with about 80 men employed. Under such conditions ore carrying less than $5 in gold a ton could be stoped, hoisted and milled at a profit. The concentrate went as high as $105 a ton in value.

Hardenburg Mine, 3½ miles south of Jackson, was last operated by Hardenburg Mining Syndicate. This company quit work in 1917 because of disappointing results of their prospecting.

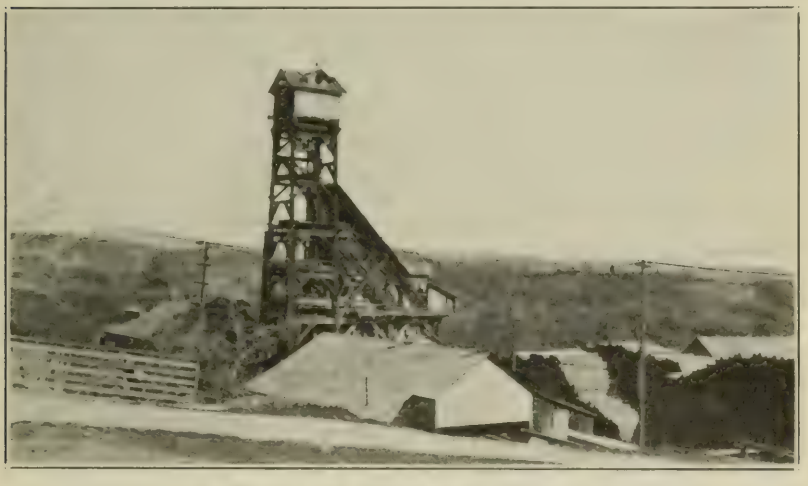
A three-compartment vertical shaft was sunk to a depth of 1500 feet, where it is reported to have struck the fissure. Above there, on the 850-ft. and 1000-ft. levels, crosscuts were run to the fissure, which is said to have carried low-grade material and a heavy gouge, making the ground difficult to hold open. There was a 20-stamp mill. In 1918 the surface plant was removed and the land sold for the benefit of the creditors, since when it has lain idle.

Kennedy Mine.

History. The Kennedy was opened previous to 1870, but until 1871 was worked on a small scale, with only a whim for hoisting. In 1871 the first hoist and a 20-stamp mill were erected. From then until

November, 1873, the production was $183,427, or an estimated value of $16.67 a ton. In 1873[1] two oreshoots were being worked. The Kennedy shoot on the north was 150 feet long and two to twelve feet wide, and the Pioneer (Argonaut) shoot was on the south end of the mine, 170 feet in length of it lying within the Kennedy property where it was 18 feet wide. The mine produced $300,000 to a depth of 600 feet. At 750 feet depth in the south shaft the ore gave out though continuing in the Argonaut.

The Kennedy was shut down and lay idle until 1885, when the Kennedy Mining and Milling Company reopened it. The south shaft was sunk 200 feet deeper, and ore was found, and this shaft was continued on the incline to a depth of 2276 feet. The north shaft was also sunk to an inclined depth of 2500 feet. The results after reopening were so satisfactory that a new vertical shaft was started about 1900 at a distance of 1950 feet east of the north shaft, and intended to cut



Headframe and Timber Pile, Kennedy Mine.

the vein at a great depth. It struck the east vein at 3680 feet, the west vein at 4000 feet, and has been continued to a depth of 4612 feet.

Production. The Kennedy produced, to the end of 1915, and to a vertical depth of 3450 feet, a total of 792,000 tons, giving a total gross recovery of $6,378,000, or an average of $8.05 a ton. This shows that, as a whole, the property was a profitable producer during that time. Between 1885 and 1900 about 36,000 tons a year were milled, at a reported total cost of $4.50 or $5.00[2] a ton. For the period 1916 to 1926, inclusive, the production was $5,991,530. This makes the total gross production of the mine to the end of 1926, $12,369,530 gold and silver. Due to the low average grade of ore between 1918 and 1924, inclusive, when stoping was principally between the 3600-ft. and 4350-ft. levels, and because of the expense incident to unwatering the mine after the Argonaut fire in 1920, the operations for those years are alleged to have resulted in a large loss for that portion of this latter period. Since then,

[1] Raymond, R. W., Mineral Resources of the U. S., West of the Rocky Mountains.
[2] Storms, W. H., Cal. State Mining Bureau, Bulletin 18, p. 53.

the grade of ore has again improved enough to pay a profit. The cost in recent years is believed to have ranged from $5 to $6 a ton. The vertical shaft was designed to make it possible to work low-grade ore at lower cost, and this was possible up to the beginning of the war. At that time ore worth $4 to $5 a ton was being milled.

Geology. The workings of the Kennedy from 2000 to 3150 feet are partly in slate and partly in greenstone (altered andesite), but at greater depth are in Mariposa slate. A rather narrow greenstone dike lies close to the vein, but tapers down to a wedge and disappears at about the 3150-ft. level, as seen in cross-section. The fissures, while crossing the slate in the oldest upper workings, were barren or nearly so, but began to carry ore again on striking the greenstone on the east. The footwall country rock west of the lode is altered andesite, changed near the vein to schist. The total width of Mariposa slate is unknown, as it has not been crosscut in the Kennedy the entire distance. Between the footwall vein and the west wall lies a layer of slate varying from a few feet to 30 feet in thickness. On the hanging wall side there has usually been a heavy gouge, from four to ten feet thick.

Due to the breaking away of an immense horse of the hanging wall slate, an east vein was developed, beginning between 1700 and 2200 feet and extending to the bottom levels. This horse had roughly the shape of a double convex lens, and at its widest part separated the veins by a distance of about 150 feet. Both north of the shaft on the 3900-ft. level, and south of it on the 4300, the veins join, and finally on the 4500-ft. level the horse is reported to have disappeared, leaving a large vein with nine feet of ore on one wall, and 16 feet on the other, and a mass of lean bull quartz between them. The footwall vein, the same one mined in the Argonaut, has been the most important.

The best ore, taken as a whole, is the banded or ribbon rock, consisting of hard white quartz with numerous ribbons of finely ground slate and often ribbons of pyrite and galena, showing building up of the vein by repeated opening of the fissure and deposition of successive layers of quartz with 1% to 2% pyrite and galena. In the footwall vein, considerable light green pyrophyllite or similar talcose mineral occurs. In most of the specimens carrying coarse free gold, it has been noticed in association with this pyrophyllite, which is probably derived from the adjacent footwall andesite.

In recent years a distance of 1400 to 1600 feet along the strike has been explored on some of the levels, and two orebodies, one about 800 feet in length, were worked. For many years drifts were run northward from the shaft crosscuts on the west vein, and southward from shaft crosscuts on the east vein, with a system of crosscuts from each of these drifts to the other vein. The heavy slate and gouge have made square set timbering and waste filling necessary. Round timbers are bought in the eastern part of the county, and heavy square timbers of Oregon pine are brought from that state. The ore in recent years has ranged from $4 to $10 a ton.

The mill of 100 stamps and 42 Frue vanners has not been in full operation during this period, and has been shut down completely at times, as at the time of the first Argonaut fire, when operations had to be entirely suspended. Fire from the Argonaut ate its way into the Kennedy workings and the latter mine had to be bulkheaded and partly flooded in March, 1920, lying idle the balance of that year, and until

October, 1921. At present, 60 stamps of the mill are dropping, and about 250 tons of ore are crushed daily. The condition of the mine as regards ore prospects is more promising than for many years past, and the recent expenditures for hoisting plant changes were based on the results of development work since Webb Smith resumed the superintendency.

Electric power has lately been substituted for steam for hoisting. Since the Argonaut fire of 1922, a refuge chamber, accessible in time of accident from both mines, has been completed in an enlarged part of the connection between the 4600-ft. level of the Argonaut and the 3900-ft. level of the Kennedy.

Keystone Mine was discovered in 1851, opened in 1852, and the production up to 1867 was 44,000 tons, which yielded $700,000.[1] From then on for many years the record of production is fragmentary. For the year ended July 31, 1868, it was $155,522, average value $12.86 a ton, the shaft at this time being 380 feet deep. In the next two years the production was about $300,000 annually, according to contemporary estimates; in 1873, about $400,000, and in 1874, 25,146 tons yielded $452,507. From the surface to about 900 feet inclined depth, ore came from the 'contact' vein, lying in the black slate, with slate footwall and altered andesite hanging wall. According to an early description, "The ground in many places is loose, and the vein seems to have been subjected to great pressure, crushing the quartz to powder." At the contact there is a massive vein from 12 feet to 200 feet thick, but this rock was generally low grade. The pay ore occurred where side stringers made into the main vein from the footwall slate. These stringers dipped 47° east. Most of the mine's production came from this kind of ore from the surface to 900 feet in depth.

The massive low-grade or barren vein occurs on the hanging wall side of an important fault that has been traced for over 2000 feet and dips east 35° to 65°. This vein is composed of crushed fragments of the diabase and quartz. The banded ore on the footwall side of this was 25 feet wide in some of the stopes, and much of it was worked without timbers, and with few pillars. On the hanging wall side of the massive vein, and separated from it by a dike of diabase, a small vein was found in a strip of black slate. This carried arsenopyrite and pockets of gold, the largest of which was found between the 800- and 900-ft. levels and was reported to contain over $100,000. Still farther west are other veins. The banded ore was stoped for a maximum length of 600 feet and an average width of 15 feet down to the 900 level, and gave out about 1200 feet deep.

The main or Patton shaft was sunk 2680 feet on 52° incline, being in greenstone from 1400 feet to the bottom. Below 900 feet in depth the fissure passed into the diabase, dipping flatter than the contact, and traversing the greenstone to a point somewhere below the 2100-ft. level, where it is presumed to strike the east slate. On the 1200-ft. level, 800 feet north of the main crosscut, a parallel oreshoot was found which was reported 130 feet long by 8 feet wide, of 'grey ore' assaying $8 or more a ton. On the 1400-ft. level, 150 feet north of the main crosscut, the vein branched. A drift was run 650 feet on the west branch, which is reported to show ore eight feet wide at this place. A

[1] Browne, J. Ross, Mineral Resources of U. S., West of Rocky Mountains, 1868.

drift 270 feet long on the east branch was in low-grade material. The grey orebody pitches south, being 400 feet or more north of the shaft on 1400-ft. level and 600 feet south of it on the 2100-ft. level, where the orebody was 100 feet long and was mined for a width of 18 feet. The 'grey ore' is mineralized diabase (or schist derived from it) which has been changed by hydrothermal action, during which gold bearing sulphide, principally pyrite, was deposited, forming a disseminated orebody, in which most of the gold is associated with the sulphide, differing from the slate ore in which most of the gold is free.

On the 2100-ft. level, 1700 feet of crosscuts were run, and on the 2650-ft. level crosscuts were run to both contacts of the diabase, and several hundred feet of drifts were run, but no ore was developed on this level within the Keystone ground. A block of ore remains above the 2100-ft. level on the grey orebody. The owners estimate there are 200,000 tons of proven ore that will yield $3 a ton; more liberal estimates have also been made.

Keystone Mining Company were the last operators and ran the mine and mill from 1911 until October, 1919. From early in 1915 until closing, 40 stamps were run, crushing about 7000 tons of ore a month. Ore averaged $2.90 a ton, according to C. L. Culbert, secretary of the company. A small profit was made at times over operating costs on even lower grade ore than this, but the margin was small. The concentrate carried five-sixths of the gold and the freight and smelter charge on concentrate was equal to 42 cents a ton milled. The filling up of the tailing storage dam and inability to obtain additional storage space, as well as rising costs, hastened closing. The company has a good tailing storage site, but this would require either an elevator or the moving of the mill.

The total production of the Keystone is estimated to have been about $17,000,000.

Lincoln Consolidated Mines include the Lincoln and the former Wildman and Mahoney holdings, there having been three separate mining groups originally, and containing in all 380 acres of mining ground with mineral rights extending from the north end of the Old Eureka property through the town of Sutter Creek to the Golden Eagle claim, a distance of about a mile along the Mother Lode.

History. The Lincoln was located about 1851, and the others about the same time. All three were worked during the '60s. The Wildman had a shaft 530 feet deep and a 12-stamp mill in 1867. It lay idle from then until 1887, when it was reopened by Wildman Gold Mining Company. The Lincoln had two shafts by 1867, one 669 feet deep and another 270 feet, and was said to have produced 3500 tons of ore annually from 1851[1] to 1867, except for two years. There was a 20-stamp mill and some of the ore was worth $15 a ton. The Mahoney had been opened to a depth of 500 feet by 1873. The vein was 45 feet wide then. It had been profitable to a depth of 250 feet, but below there was in low-grade material. The early-day production from the Wildman to a depth of 500 feet, the Mahoney to a depth of 300 feet, and from the Hector portion of the Stewart is estimated to have been about $1,500,000. The Mahoney was 900 feet deep when bought by the Wildman Company in 1894.

[1] Browne, J. Ross, Mineral Resources of U. S., West of Rocky Mountains, 1868

The Wildman and Mahoney were worked by the Wildman Gold Mining Company until 1906, then closed down until 1908, when they were reopened and worked until 1911, since which year they have been idle. The Wildman shaft reached a depth of 1400 feet on 72° incline; Mahoney shaft, 1200 feet deep on 62° incline, and Emerson vertical shaft 616 feet. The Lincoln, after lying idle about 30 years, was reopened in 1898 by Lincoln Gold Mine Development Company. The three groups were taken over by the Lincoln Consolidated Mining Company after 1906. The Lincoln shaft reached a depth of 2000 feet on an incline of 63°. The Lincoln was not productive below the 400 level, but the Wildman was stoped to about 1400 feet and the Mahoney to 1200 feet deep.

Geology. The Mariposa slate between the Old Eureka Mine and Amador City is split by a tongue and smaller dikes of altered andesite and the mines of this company are grouped around the slate-andesite contact. The andesite (or diabase) has been in part altered to amphibolite schist. Going north from the Wildman the vein increased to 45 feet in width on the surface, and is said to have supplied much rich ore in the early days. It branched, or was split by a greenstone horse, at the north end of the Mahoney, one branch turning eastward into the Hector portion of the Stewart, with greenstone on the footwall, the other branch passing into the Lincoln with schist, and farther off, greenstone on the hanging wall. There was usually a heavy gouge, with ore at times on both sides of it. The ore in the Wildman and Mahoney was in the contact vein, along the schist-slate contact, in the upper levels. At depths reached in the earlier operations, namely about 500 feet deep in the Wildman and 250 feet deep in the Mahoney, the mineralization began to pass from the contact into the schist, where large bodies of low-grade altered schist, impregnated with pyrite, were found. The gray schist ore was on the footwall of the solid quartz vein. The wide section of rock on which mineralizing solution acted resulted in dispersal of the gold to such an extent that it was necessarily lower grade than if it had been confined to a narrow fissure. The schist dike was from 60 to 295 feet thick. Mining in the contact vein continued to the 1300-ft. level in the period between 1895 and 1899, the ore coming from that vein between the 500- and 1300-ft. levels and being of low average grade. In 1899 the development of small oreshoots found by diamond drilling in the schist dike began. As they had no dump room for waste on the surface, they milled everything that would pay for crushing, and the average grade was far below that needed to make ore, even at the low cost of operation.

After the Lincoln shaft was sunk to 2000 feet a drift was run south over 2200 feet, passing through the Mahoney claim and to a point under the Wildman 1400-ft. shaft. Long crosscuts were run into the footwall from the 500-, 1200- and 1950-ft. levels of the Lincoln shaft, and on the 1200-ft. level one was run into the hanging wall, all apparently without finding ore.

In the Wildman Mine, the north drift on the 1400-ft. level was run 437 feet and the south drift 666 feet. For a length of 250 feet on the north, the vein averages five feet wide, but the assay value is not known. In the south drift, according to information furnished from owners' records, ore began to make 193 feet south of the shaft and increased to 25 feet in width within 185 feet. A horse of ground had slipped into

the fissure here, causing a pinch in the vein for about 75 feet. Beyond this, the vein began to widen again, increasing from 10 feet just south of the horse to 100 feet wide at the face. This latter width was sampled in sections of five feet each, and the resulting average of the 20 samples was reported to be $3.62 a ton. The general pitch of the Lincoln-Mahoney-Wildman orebodies appears to be southward, as is true also in the mines nearby on the south.

Production. There were three periods of production for these mines, of which the first was the production from the shallow zone to a depth of 400 feet in the Lincoln, 500 feet in the Wildman, and about 250 feet in the Mahoney. The exact figure for the total output for this period is unknown, but has been estimated at $2,000,000 for the Lincoln (probably excessive), and $1,500,000 for the Wildman and Mahoney, prior to 1887.

The Wildman Gold Mining Company started with a 10-stamp mill, which was enlarged to 20 stamps, then to 30. From 1887 to May 1, 1894, they produced from the Wildman Mine 94,206 tons of ore which yielded a gross output of $417,561, after deducting freight and smelting charges on concentrate, and bullion refining charges.

From 1894 to October 1, 1901, they produced from the Wildman property 234,945 tons of ore of a total gross value of $834,671, or $765,347 after deducting for freight, smelting, etc. In the same period they produced from the Mahoney 269,681 tons which yielded a gross output of $518,037, or $439,471 after deduction of freight and treatment. Between 1895 and 1899, inclusive, the total average cost of mining and milling, including development and other improvements except enlarging mill, was $2.59 a ton. During this time, the operations at the Wildman yielded a net profit of $211,712. The operating loss at the Mahoney was $144,040. Each mine was equipped with a 40-stamp mill, containing 750-lb. and 950-lb stamps. There is no record of the output between 1908 and 1911, but it is believed to have been small.

Lucky Strike (*Moar Bros.* or *Pioneer*) *Mine.* Owner, Mrs. Louise Cassinelli, care L. L. Patrick, Volcano. It is near Pioneer Station.

The geology of this region in general is similar to that of the West Point district in Calaveras County, adjoining on the south. The ore was stoped to the water level by former operators. An adit between 600 to 700 feet long early in 1927 gives backs increasing from 90 feet to about 400 feet as it goes farther into the hill. This passes under the old work. The principal oreshoot, according to Robert Duncan,[1] who recently examined and sampled it, is 180 feet long, 23 inches wide and of excellent grade. A second oreshoot, of low grade, was also passed through and indications of a third have lately been encountered. On the principal oreshoot, little has been done below the adit level to prove the downward extension of ore.

The property has been under option lately, but only a small crew has been employed.

Marklee Mine. Marklee Mining Company, 105 Federal Realty Building, Oakland, Cal. This company had cleaned out the first 230 feet of the old main shaft of the Marklee Mine and had done a good deal of work on the surface up to the middle of March, 1924, at which

[1] Mining Engineer, address Moore Mine, Jackson, Cal.

time they had suspended work. It is reported that over $18,000 had been spent.

The main shaft, in which the rich shoot of early days was found, is about 500 feet deep. The strike of the vein is north of west and the oreshoot is said to have raked away from the shaft, necessitating longer drives on each succeeding level. The mine was discovered in 1868 and, according to a report by the original owners in 1869, was 100 feet deep the autumn of that year and was producing ore of an assay value of $60 a ton, from which only $30 a ton was recovered, on account of lack of facilities for saving sulphides. While the lapse of time has been so great that definite details are hard to get, it seems certain that the main oreshoot was quite short and that the bottom level had not been run far enough to prove the shoot, although a body of $4 ore is said to have been found on that level. Besides the main shaft, a drift was run from near the shaft collar for about 800 feet along the vein, and three winzes were sunk to depths of 350, 100 and 140 feet, respectively. There is said to be about 200 feet of blank ground on the vein between the two oreshoots, the second of which is said to have been penetrated by the farthermost winze, and is said to be about a foot wide. The mine is about five miles from Volcano. It is equipped with a 10-stamp mill, boiler and steam engines and small lumber sawing plant.

Later the company resumed work, finished unwatering and spent considerable money clearing and prospecting the old workings, but were unable to find the ore expected and work was stopped in 1926.

Moore Mine. This property had been idle about 35 years when a local stock company began the work of reopening in August, 1921. The old shaft below the water level was found in fairly good shape, but the fifth level, which had previously been drifted 400 feet in the heavy, crushed black slate in the main fault, was caved full. The shaft was sunk on an incline of 52° and this level is at an inclined depth of 435 feet. It was reopened, but did not carry pay. The black slate here is about 60 feet wide. In a fissure branching from the main fissure, and striking nearly due east into the amphibolite schist on the hanging wall side, a vein of quartz ribbon rock was found which carried four to twelve feet of ore. This gave such flattering prospects that a new 20-stamp mill and other buildings were erected and a tailing dam was built in 1922.

The mill crushed its first ore in October, 1922, but the first real mill run was for 23 days in December of that year, when 2265 tons milled gave an average recovery of $6.35 a ton, with a high tailing loss. The great disparity between the previously announced assay values and the recovery was also partly attributed to stoping too great a width. As much as 32 feet in width was mined on the fifth level, including considerable schist which carried sulphides and proved to be low grade. The sixth (540-ft.) level was opened and drifted 213 feet northwest and 50 feet southeast, with ore for a length of about 100 feet. On the 640-ft. level, ore was stoped for a length of 300 feet and an average width of nine to ten feet, but at one place it was 16 feet wide where there was a sharp bend. During 1923 the mill operated 8½ months and the total production was $118,274.

When the shaft was sunk to the 800-ft. level, it was found that the orebody had been faulted and a raise had to be put up and another

level opened at 750 feet to pick up the bottom of the upper section, which had a stope length of 250 feet and a width of four to twelve feet. The low-grade drag material in the path of the fault was milled. The shaft was continued during 1924 to the 1100-ft. level. Ore was found in the shaft at 1060 feet. On further sinking, it was found to be cut off at the 1200-ft. level by the contact fault, and work on the 950-ft. level showed it did not extend upward beyond there. The production during 1924 was $150,243.

Early in 1925 a program of prospecting was laid out and begun. On the 1100-ft. level in the northwest drift, 500 feet from the shaft, some low-grade quartz was found, but did not develop into ore. The southeast drift on the 1200-ft. level was run to prospect the Zeila fissure. The total holdings of land meanwhile were increased to 580 acres under options. This prospecting work was continued during 1925 and 1926. The shaft was sunk to the 1800-ft. level (on 55° incline). On the 640-ft. level a fissure supposed to be the South Jackson vein was struck 770 feet west of the shaft and was drifted on 90 feet north and 150 feet south. It was only one foot wide and carried no ore here. Drifts on the main fissure on this level were run 220 feet southeast and 455 feet northwest without finding ore. On the 1800-ft. level a crosscut 170 feet northeast struck a vein supposed to be the Moore vein, which at that point was 18 feet wide and gave some good assays. It was opened for a length of 150 feet and was also found on the 1500- and 1650-ft. levels. It did not come up to expectations, although some ore was developed in it. On the 1800-ft. level, the main footwall gouge was followed north 1080 feet up to March 21, 1927, and is now in the South Jackson property. On the same date the west crosscut on this level, which crossed the supposed South Jackson fissure in January, had reached a length of 1120 feet, and was thought to be within 500 feet of the so-called Kennedy-Argonaut fissure. The shaft has reached a depth of about 2100 feet and will be continued to an inclined depth of 2500 feet.

The company reports a total production up to the end of 1926 of $415,741, representing an average recovery of $6.52 a ton. There has always been a large indicated tailing loss at this property, judging by the disparity between average assay values for mill-heads and actual recovery. Even after accounting for this disparity, which should be practically the same as the assay value of the tailing, there have been alleged losses variously ascribed to theft and to the presence of galena and orpiment in the ore. Both these minerals slime badly. Recovery has averaged 80% or less of indicated mill-heads.

The Moore plant has been the only complete one of any size erected along the lode in this county since the war, so the cost figures for the different items should be of interest.

COST OF PRINCIPAL ITEMS OF MOORE MINING AND MILLING PLANT, ERECTED 1923–1924.

Mill, twenty 1200-lb. stamps, twelve 6-ft. Frue vanners, building, etc.	$50,072 00
Hoist building and hoist equipment (3000 feet depth capacity)	10,302 00
Headframe and equipment	7,902 00
Blacksmith shop and equipment	1,971 00
Timber shed and equipment	2,481 00
Tramway from hoist to mill (500 feet long, 2½-ton automatic side dump cars)	5,927 00
Underground equipment	13,167 00

From the sales of stock to finance the company's earlier operations, the sum of $182,391 was realized. In 1925, Frederick H. Rindge paid $150,000 for 1,971,372 shares, representing over 51% of a total of 3,629,606 shares outstanding. A large sum has also been raised by assessments, so that to date the operations have resulted in a loss. The company must be given credit for a persistent and courageous search for ore in the face of unexpected fault conditions which have upset all reasonable calculations.

Mountain King Consolidated Mine (*Pitts*). Owners, W. B. Pitts and Mrs. Louise Pitts, Pine Grove. In 1924 the property was under option a short time, and some preliminary prospecting was done by Alva S. Archer and associates, but disagreements led to abandonment of work.

There are two series of veins and rich ore has been found near their intersections. On an easterly striking vein a shaft has been sunk 265 feet, with a level at 250, but there is no record of production from it, though some good prospects were reported in sinking. About 150 feet north of this, a northerly striking vein comes in from the south up to the first fissure, and the Anaconda shaft was sunk 125 feet on this second vein near the intersection. This vein is said to have yielded a good gold production under romantic circumstances, but there is no written record. A tunnel was run from the creek 70 feet lower than the shaft collar, northward for several hundred feet, with two forks, and high-grade ore was found in both directions, on the north in a winze that was started by the last lessees and in an old raise put up by other operators. The veins in this part of the property range from one to six feet wide. Another vein, 250 feet north of the deeper shaft, appears to cut off the east striking vein. There are other veins on the property that have not been developed. The geological indications in the tunnel are promising, but it is evident that most of the work done heretofore has been in search of pockets and no attempt has been made to develop milling ore. The richer ore shows gold in galena.

The reported production was $18,000.

Newman Mine. Owner, Fike Brothers. Lessee, Simon Shaw. On North Fork of Mokelumne River, one mile east of the Jackson-West Point road, in the West Point area of granodiorite. An adit has been run 800 feet, and good ore is reported in a vein one foot wide in a winze sunk 80 feet below this level. This winze is below the river level and water has caused trouble. A new adit is 70 feet long.

The property is equipped with a 10-stamp mill, four concentrators and air compressor, operated by water power.

North Star, McIntire, Boyson, Occident, Granite State and part of Beatrice claim were under option the past two years to California McIntire Mining Company for which Fletcher Hamilton was agent.

A shaft about 1000 feet deep on the North Star claim was unwatered to the 600-ft. level and considerable new work was done. The claims are on the Mother Lode north of Sutter Creek. The greenstone lies on the footwall, followed on the east by Mariposa slate containing the usual greenstone dikes. Most of the work was done on the North Star and McIntire claims. The old work on the North Star, besides the shaft, included a crosscut southwest on the 600-ft. level and a drift

2500 feet northwest on a gouge and scattered quartz seams in the slate in search of a possible continuation of the South Spring Hill orebody, which is said to have occupied the same fissure. No ore was found.

The new work included a crosscut 100 feet northeast to a contact of greenstone and slate with drifts 400 feet each way on the contact, which was found to be frozen and barren; the southwest crosscut was also extended 500 feet farther, making it 800 feet long. Here the footwall contact of greenstone and slate was prospected. Two gouge-filled fissures, 50 feet apart, were encountered. Going in a northerly direction from this crosscut for a distance of 550 feet, the face reached a point 180 feet from where the bottom of the 200-ft. McIntire shaft would have been, had this shaft been deepened. Southwest, these gouge-filled fissures were cut at several points, 400 feet of new work having been done in that direction. The gouge and black slate showed only small scattered bunches and seams of quartz, and Roger Beals, who was superintendent, stated that assays showed nowhere over a few cents in gold, although it had been claimed that there was a prospect in the McIntire workings, on the 200-ft. level. This work off the southwest crosscut prospected the McIntire ground for 950 feet. The work on the hanging wall contact first mentioned prospected that contact on the east side of the North Star claim for 800 feet. Three crosscuts into the greenstone, each about 60 feet long, developed nothing. The greenstone there is about 300 feet thick. The old drift, 2500 feet long, prospected the Boyson and South Keystone claims and a crosscut from it is said to have prospected part of the South Spring Hill claim.

Two conditions are noticeable in the workings on the 600-ft. level—first, the dryness of the ground, and second, the absence of any cross veins. The slate is plicated in small broken folds in places, and ground to gouge along the fissures with considerable quartz intermixed; but the very low reported assays indicate that the absence of ore is not due to faulting. The gouge has so completely dammed the fissures that although considerable water enters the shaft from the surface, and a small stream also runs along the lode, the workings are dry away from the shaft.

The company quit work about the middle of March, 1927.

Old Eureka (Amador Consolidated or *Hetty Green Mine)* has been purchased by Central Eureka Mining Company, which operates the adjoining property on the south. At this time, the Old Eureka is being unwatered, and the new owners were advancing one of their upper levels northward into the mine late in 1926.

The Old Eureka was opened in 1852 and the first mill, of 10 stamps, was erected the same year on the Eureka claim. It was successfully operated until 1881, when work was stopped at a depth of 1965 feet. Two veins called the 'boulder ledge' and 'true ledge' were worked. The 'boulder ledge' was on the west and was 15 to 20 feet wide and yielded $10 a ton, apparently having been of best grade between the 800- and 1350-ft. levels. The 'true ledge' varied from three feet to 15 feet wide in the middle levels and was of much higher grade. The richest part of the mine was apparently about 1000 feet in depth, where the ore averaged $27 a ton. The oreshoot was 500 feet long, and was evidently bottomed between 1700 and 1800 feet deep. The ore value varied over wide limits; for example in December, 1872, it

averaged $35.19 a ton, and in December, 1873, $6.65 a ton, averaging for 14 months, $17.91 a ton, recovered.

Total figures of the mine's production are not available but it is believed that $12,000,000 to $13,000,000 is a fair estimate, judging from known output for several years where exact figures are at hand.

In 1917, a well-financed company bought the property and unwatered it. The shaft was found in bad shape on account of having been sunk in the slate and about $200,000 was expended for equipment, pumping and shaft repairs, the last two items alone amounting to $117,657. The shaft was deepened to 3500 feet and levels were run north and south on the main vein fissure at 1700, 2125, 2950 and 3500 feet.

The main vein was found to have had a slate footwall with heavy gouge and greenstone (altered andesite) hanging wall in those workings that had furnished ore. The andesite extends for 800 feet on the strike, and the ore was stoped for 450 to 500 feet on the strike and



Old Eureka Mine, a noted early-day producer, with a yield probably in excess of $12,000,000.

evidently cut out, both on dip and strike, with the thinning out of the andesite, about the 1700-ft. level. The shaft and most of the other workings beween 1700 and 3500 feet in depth were in Mariposa slate, which is soft and swelling ground. The andesite lens thinned out to such an extent that it was no longer a factor in controlling fissuring, and the vein for the most part was a mass of barren or low-grade stringers in the slate between these levels. Wide veins of low-grade quartz were coming in at the south faces of the 2950-ft. and 3500-ft. levels. The former level was run to the Central Eureka end-line. A number of crosscuts were run without striking ore, although many think that the possibilities in this exploration of the walls of the main vein had been far from exhausted when work was stopped. The longest crosscut was 800 feet west on the 3500-ft. level. No ore of milling grade was found except a few small pockets.

The following are the positions of other veins with relation to the main Old Eureka vein:

Central Eureka lower (present) oreshoot is reported about 300 feet west of Old Eureka vein at the common end-line at 3500 feet in depth. Due to the direction of this end-line the length of the original Central Eureka claim along the strike shortened rapidly in depth. This vein was reported low grade where crosscut in the Old Eureka. As the later developments in the Central Eureka on this oreshoot have been principally below the 3500-ft. level and have extended to date to 4550 feet in depth, and several hundred feet north of their shaft, this is an example of the uncertainties of mining. The purchase of the Old Eureka prevented possible expensive litigation.

The Railroad vein is about 500 feet east of the main Old Eureka vein. It produced $70,000 to a depth of 340 feet, the reported grade of ore being good.

The Wolverine vein is probably a little in the footwall of the Old Eureka.

The Wildman-Mahoney vein and the Lincoln vein are several hundred feet west.

Original Amador Mine, adjoining the Bunker Hill on the south, was first opened in 1852. The geology and mine workings were described by James D. Hague in 1872 and the next two paragraphs give a synopsis of his report.

The underground workings extended 650 feet northwest from the south boundary. There were three shafts, of which the south shaft was 175 feet deep, the middle one, 196 feet northwest from the first, was 356 feet deep, and the third shaft was just started. The vein, having hanging and footwall seams, varied from one to 20 feet wide, had a hard, slaty greenstone hanging wall and black slate footwall. The hanging wall vein was usually the larger, was of hard, white quartz, frequently mixed with greenstone and sometimes joined to the greenstone of the hanging wall with no gouge nor well defined limit between. The footwall vein was narrower, and in the black slate. It showed an abundance of clefts or crevices in which were seams of sulphurets and visible free gold. This vein was always the richer of the two, and was stoped in the old workings (above 356 feet in depth), while the hanging wall vein was left. The veins at times were together, at times separated. Below the third level the vein pitched east into the greenstone, with 50 feet of greenstone between the vein and the footwall slate.

A 40-stamp mill was completed in 1872, an English company having purchased the property. About 3600 tons of ore crushed yielded from $4 to $6.50 a ton, and the tailing loss was $2.50 to $3.26 a ton. This company spent considerably more than they took from the mine during the next two years, but no complete record of their work remains.

The later work by Original Amador Consolidated Mines Company began in 1898 and continued until early in 1917, since when the mine has lain idle. The shaft was sunk to a depth of 780 feet, on an incline of 72° to the 200-ft. level and 45° below there. The slate vein was prospected for 900 feet and the contact vein was also extensively prospected. In the greenstone east of the contact vein, three other veins were found, consisting of schist and quartz stringers. A large tonnage of low-grade ore was developed, estimated to average about $3 a ton. Previous to 1915 a mill of twenty 1000-lb. stamps and eight Deister

concentrators, with a capacity of 90 tons of ore daily, was operated. The ore crushed during this period averaged about $3.30 a ton and the total operating cost averaged $2.56 a ton. However, it should be stated that during part of this time the ore came from development work. About two-thirds of the gold recovered was free. The concentrate averaged about $80 a ton and the recovery was about 90%. The mill was remodeled in 1915. Two 8-ft. by 3-ft. Hardinge mills, classifiers, etc., were installed and the capacity was trebled. Closing was hastened by complaints of farmers regarding damage to their lands by tailing.

This mine and the Bunker Hill are now under the same ownership, and the Original Amador could be prospected at considerable depth through the Bunker Hill shaft. Both mines contain considerable low-grade ore.

Plymouth Consolidated Mine at Plymouth has undergone many changes since our last report in 1923. Under the Plymouth Consolidated Mining Company, the main shaft was sunk 900 feet from 3400 to 4300 feet. For some time previous to this ore had been mined through a winze, hoisted to the 3400-ft. level, then trammed to the shaft to be hoisted to the surface. Both shaft and winze were in poor shape and work was at a disadvantage. In February, 1925, the mine was forced into a receivership and closed February 28, because of inability to pay notes amounting to $50,000 secured by a mortgage. In May, 1925, it was bought by Argonaut Mining Company, and was reopened at once. The shaft was sunk an additional 150 feet, making its total depth 4450 feet, of which the first 1600 feet is vertical and the balance on an incline of 60°.

The principal orebody has been stoped out between the winze and shaft as far down as the 4300 level, and is being stoped now from the 4450 to 4300 level. Ore occurred in it in the shape of comparatively small lenses. The operation of this mine had not paid a profit for a number of years under the former company, and the average grade of ore has remained low since the present operators began milling, and they have made no profit, although they have reduced costs by eliminating overhead expenses and improving operating methods. They are milling 3500 to 4000 tons of ore a month and have been running the mill since May, 1925, except for five months between April and September, 1926. The oreshoot in the levels worked in late years has had an average length of about 275 feet and an average width of 11 feet. This is north of the shaft. On the 3400 level, south of shaft, another small orebody about 100 feet long is being stoped and prospected.

The Empire oreshoot, on the north, and Pacific oreshoot on south merged at about the 2900-ft. level. The ore in the Empire oreshoot has always been bounded on the north by a meta-andesite dike entering from the footwall side. This outcrops 2850 feet north of the Pacific shaft, and where crosscuts have passed through it had a thickness of about 100 feet. The gouge and ore stop at this dike, which persists to the greatest depth yet reached. In the lower levels the andesite turns away from the shaft on a curved course, indicating that it may be lens-shaped and may disappear at greater depth, as is at times the case with these dikes in the mines on this lode. On the lowest level the northern end of the orebody is now 800 feet north of the main shaft.

If the thickness of the dike is only 100 feet where crosscut, it must be a branch from the large mass of altered andesite extending many miles north and south. There is a gouge about two feet thick along the contact of the andesite, marking a fault of unknown amount or direction.

The main fault in this mine has been classed as reverse and post-mineral, having the same strike as the vein. It is marked by prominent gouges. In the upper workings it followed the footwall, but crossed the vein to the hanging wall side a little below the 1600-ft. level.

The oreshoots were found at or near the intersections of various veins which occur as seams or series of seams and banded quartz, the ribbons or bands containing graphite, slate, pyrite and arsenopyrite. Two vein systems occur, one striking north and the other N. 20° W. Both systems dip east, the first about 65°, cutting the cleavage of Mariposa slate both in strike and dip, the second from 70° to vertical, conforming more with the cleavage of the slate. The nature of this publication does not permit a full discussion of the interesting geologic features of the mine.

The total production of the properties now comprising the Plymouth Consolidated has been in excess of $13,000,000. The old companies between 1860 and 1891 produced $7.123,000 and Bewick, Moreing & Company between 1914 and 1925 produced about $6,000,000. The average value of all ore milled between 1860 and 1924 was $6.75 a ton. The operating cost during the past few years has been from $5 to $5.75 a ton, slightly exceeding the yield of ore.

Smith-Vincent Mine. Owner, Lewis Smith, Oleta. Lessee with option to purchase, Oleta Gold Mining and Milling Company. Charles Crane, manager, Oleta. It is about one mile northeast of Oleta, near the Fairplay road.

There is a shaft 300 feet deep, with one level at 150 feet and drifts 80 feet and 150 feet long on a vein said to be 2½ feet to 7½ feet wide; but mine was closed and full of water, so these figures could not be checked. The shaft crossed the vein about the 150-ft. level, and crosscuts will have to be run to reach it below there. There are other veins of good width on which little has been done. The country rock is amphibolite schist, forming a small lens surrounded by Calaveras schists.

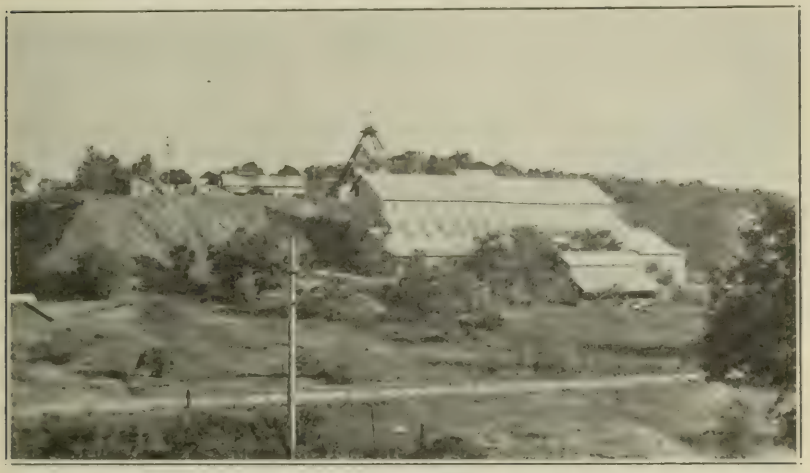
The above company installed an 80-h.p. steam boiler and 65-h.p. hoist and an air compressor, after discarding a smaller outfit. Oil for fuel was hauled 18 miles from Martel. When visited in August, 1926, the property was being prepared for reopening after having been shut down six months.

South Eureka Mine includes the Oneida Mine and the holdings cover practically all the mineral rights from the Kennedy on the south to the Central Eureka, including 401 acres.

The Oneida was one of the richest of the early-day producers. The ore on the hanging wall side was the best, yielding $30 to $40 a ton, according to J. Ross Browne.[1] The average yield in 1867 was $22 a ton and in 1868 it was $16 a ton.[2] In 1871 there were three shafts, 300, 700 and 800 feet deep, respectively. The vein was drifted for a

[1] Mineral Resources of the U. S., West of the Rocky Mtns., 1868.
[2] Raymond, R. W., Mineral Resources of U. S., West of the Rocky Mtns., 1869.

length of 800 feet on the 700-ft. level, and the oreshoots were said to have been 700 feet and 400 feet long. These old workings finally reached a depth of about 1000 feet, after which the property lay idle until 1896. In that year a new vertical shaft was started and it was expected this would strike the vein at a depth of 1750 feet, but on account of the vein assuming a steeper dip, it was not struck until the 1900-ft level. This shaft reached a depth of 2280 feet, and an inclined winze was sunk 250 feet at a point 280 feet north of the shaft. The mine was worked extensively from the 1200-ft. to the 2200-ft. level. On the 1200-ft. level, the vein was drifted 2700 feet, on the 1500-ft. level 2050 feet, and on the 2000-ft. level about 2300 feet. Ore was stoped from the latter level to the old workings. A 60-stamp mill was used. Operations continued until 1913, since when the mine has lain idle except for some work done through the South Eureka shaft. The production of the Oneida was about $2,500,000. The main oreshoot



Mill and Surface Plant of South Eureka Mine, a former producer of the Mother Lode, near Sutter Creek.

had a length of 650 feet and an average width of 12 feet in the upper levels and five feet in the lower, but reached 20 feet in width in places.

The South Eureka lay undeveloped until 1891, due probably to the fact that most of the surface along the course of the Mother Lode fissure through the property is covered by andesite cobbles. In that year an inclined shaft was started which finally reached a depth of 2785 feet. To a depth of 900 feet the fissure was filled principally with crushed slate and gouge, containing only a little quartz. The ground was very heavy and the shaft expensive to keep open on account of having been sunk in this crushed slate. On the 900-ft. level, a crosscut revealed some ore on the east contact (hanging wall) of black slate and greenstone, but for the most part the ore was scattered in bunches in the gouge-filled fissure and did not make a good sized or profitable oreshoot. For ten years assessments were levied to continue prospecting. During this period a 20-stamp mill was in use part of the time. After 58 assessments had been levied and the 2750-ft. level had been reached,

a crosscut to the footwall encountered an important oreshoot. This was subsequently developed by crosscuts from the higher levels, and was stoped up to about the 2000-ft. level. The mill was increased to 80 stamps and the property for several years was one of the largest producers of the county, employing from 200 to 250 men. This oreshoot crossed the line into the Central Eureka property on the latter's 2700-ft. level, but went down only 30 feet there. The South Eureka Company sank a winze to 2900 feet inclined depth, drifted back and raised but failed to find more ore. They quit in 1918.

In 1921, the Central Eureka Mining Company took an option on the property and extended several of their deeper levels into the South Eureka. The 3350-ft. level south drift was run to a point 120 feet north of where the South Eureka shaft would be if continued. A west crosscut was run in greenstone near the north end-line of the South Eureka on this level. On the 3900-ft. level, the drift was extended about the same distance into the South Eureka, and a crosscut was run east in slate 740 feet. This cut several gouge seams and vein formations but no ore was found. The 4100-ft. level was also run into the South Eureka. The result of all this work was disappointing.

Since the South Eureka Mining Company quit, the shaft as far down as the 2740-ft. level, and the workings connecting the two mines on that level (Central Eureka's 2540-ft. level) and on the 1800-ft. level (Central Eureka's 1600-ft. level) have been kept in repair by the Central Eureka Mining Company. Water from the lower part of the Central Eureka Mine is pumped to their 2540-ft. level and piped thence to the South Eureka pump station which is maintained and operated by the Central Eureka Mining Company. The South Eureka shaft, over which the hoist is kept in running order, also serves as a second exit.

The 80-stamp mill had a capacity of 400 tons a day through 24-mesh screen, and a recovery of 85% to 91% was claimed, using amalgamation followed by concentration on 48 Frue vanners, according to the regular Mother Lode practice. The value of ore milled in 1914 and 1915 ranged from $3.60 to $4.34 a ton and in 1915, 145,124 tons were mined and milled, giving a recovery of about $575,000. The operating cost ranged from $2.80 to $3.09 a ton in those years.

South Spring Hill Mine, adjoining the Keystone on the south, was worked to a depth of 1200 feet on the contact vein, on part of an orebody worked also in the Keystone. The portion within the South Spring Hill is said to have been 600 to 750 feet long and the mine's production is reported to have been about $2,000,000. The ore was higher grade than that last mined in the Keystone. This mine has been idle about 25 years. Its principal period af activity was about 1888–1890, it having been in operation at intervals since 1851.

The property includes the Medean and Talisman claims, on both of which early-day discoveries were made, and on which shafts were sunk, each to a depth of about 600 feet. The Keystone Mining Company has recently purchased the South Spring Hill holdings.

Sunset Mine. Being operated by Sierra Metals Corporation. B. W. Bours, general manager, 701 Crocker Building, San Francisco. Ben Sanguinetti, superintendent. It is three miles southwest of Martel by road.

This property was first worked 50 years ago, but had lain idle a long time until reopened by Ratto in 1922. Some promising ore was found and the claim was taken over soon after by the company.

The deposit is a gash vein of quartz in the diabase. The vein strikes north to northwest and dips east. It has the form of lenses, one of which will pinch when followed along the strike, to be succeeded by another. The diabase is altered and oxidized to about the 400 level and the difference in appearance between this oxidized zone and the fresh rock below there led to the erroneous belief that the two were different rocks. The walls of the vein are hard, with little gouge. The white quartz contains a little arsenopyrite, pyrite and copper minerals as well as free gold.

The inclined shaft is 600 feet deep, with levels called the 300, 400 and 500. Crosscuts run east to the vein with drifting 400 feet north on the 300 level, 120 feet north on 400 level, and 160 feet north and 40 feet



Treasure Mine and Mill.

south on 500 level. The width of vein varies from three feet to a few inches, and the value is spotted. Some specimens show considerable free gold, but 1200 tons crushed were of medium to low grade.

The surface plant includes a mill of five stamps with a daily capacity of 20 tons, a Frue vanner, 2-drill air compressor, 35-h.p. electric motor, and hoist run by 22-h.p. motor.

Treasure (Hazard) Mine was first worked previous to 1867, at which time it had an 8-stamp mill. It had produced 5000 tons of ore, some of it worth $15 a ton, up to that time. It was reopened in 1907 by Treasure Mining Company, and operated until September, 1922.

The Treasure Mine adjoins the Bunker Hill Mine on the north. It was worked to an inclined depth of 3030 feet, the first 1600 feet of which is a shaft on an incline of 58° to 60° and the balance a winze. Levels were run about 160 feet apart, the later workings having extended from 1800 to 2970 feet, and connection was made between

the 1600 level of the Treasure and 1500 level of Bunker Hill. The upper levels worked the usual Mother Lode veins, but about the 400-ft. level the vein passed from the slate into the meta-andesite or 'schist,' which furnished the ore mined in later years. This was a disseminated sulphide ore, formed by the alteration and impregnation of the 'schist,' which contains minerals susceptible to chemical solution, so that the original constituents of the rock have been largely changed and charged with 2% to 4% auriferous sulphides, principally pyrite. This orebody was reported 18 feet wide. It was cheaply mined, and a method of ore treatment different from that practiced elsewhere on the Mother Lode was followed. It is described because it differed from the standard practice so radically.

Ore from the skip was dumped over a one-inch grizzly. Oversize ore passed to a gyratory crusher, product from which passed to a trommel 10 feet long with largest screen openings 1½-inch. Minus $\frac{7}{16}$-inch ore passed to fine ore bin and plus $\frac{7}{16}$-inch, minus 1½-inch, to coarse ore bin. Oversize from the trommel passed to a 7-inch by 10-inch Dodge crusher, and then to coarse ore bin. Belt conveyors fed coarse ore to a large Hardinge mill and fine ore to a smaller one. The large mill ground to ¼-inch and the pulp from it passed to a Bunker Hill revolving screen (slots equal to 16-mesh) where it was thinned. Fines through screen went to shaking plates and coarse sand retained went to a small Hardinge mill, from which fines passed to shaking and stationary plates and coarse was returned by sand pump to Bunker Hill screen, etc.

Pulp from the plates was pumped upstairs to classifiers, from which coarse pulp went to two Wilfley tables, the tailing from which was reground; fines (overflow) went to cone classifiers which discharged their underflow to two Overstrom concentrators and overflow to eight Frue vanners. Electric power operated a 35-h.p. motor for the large Hardinge mill and a 75-h.p., 440 volt, 93 ampere motor for driving the rest of the machinery. The rated capacity was 150 tons in 24 hours.

The best ore in the mine was above the 2320-ft. level, below which a fault cut off ore, although a large low-grade vein was reported below. This fault is important to all three adjacent mines. It strikes east and dips south, traversing the property. The Treasure Mine made a gross production of about $1,000,000, but paid no dividends as the surplus was exhausted looking for more ore.

Velvet Mine. Owner, Charles Hagberg. Lessees, Ray and Victor Hageman. The lessees took out about 27 tons of ore in 1924 that yielded $1100. This was said to have been taken from a shaft 60 feet deep. There is a small steam hoist and compressor here. The Pine tunnel, about 100 feet long, was run many years ago and is in very hard rock. This property is near the Defender Mine, in the granodiorite.

Zeila Mine (originally called the Coney) and the *Blue Jacket* adjoining, were known even in early days as mines whose ores carried their gold largely in the sulphides, differing in this respect from most of the others on the Mother Lode. The Zeila is at the south side of the town of Jackson, on the most easterly of the veins of the Mother Lode. The property was shut down in 1914 after operating over 30 years, and has lain idle since. Therefore no recent first-hand information has

been obtainable, and former published reports except one by Storms (see post) are meager and mostly valueless. The Zeila is one of the mines which could be worked at a profit under conditions which existed prior to 1914, but so far as can be learned the ore has been of uniformly low average grade. According to Folio 63 of the U. S. Geological Survey:

> "The vein is essentially a stringer lead in amphibolite schist and has a general dip of 50° to 60° E. It is separated from the black slates (Calaveras formation) of the footwall by a heavy gouge. The width of the vein where stoped is 40 to 50 feet, but the general average is somewhat less. A fine-grained, altered dike, from 4 to 6 feet wide, probably originally a diorite, accompanies the vein. The ore is of low grade—less than $4 per ton. Pyrite is the principal sulphide, but there is sometimes a little molybdenite, and small quantities of galena and zincblende are said to occur and to indicate good ore. Calcite is quite abundant, both as stringers and crystallized with the quartz."

The shaft was sunk 1700 feet on an incline of 65°. The 1570-ft. level drift was run north 3000 feet, and on that end a winze was sunk 458 feet, with levels at 157 and 295 feet, which were also drifted north, the latter 450 feet. At the time of closing it was stated the mine contained 360,000 tons of ore averaging less than $4 a ton. It was stoped out from the 1200-ft. level to the surface, north of the shaft, where the oreshoot was 600 feet long and averaged 20 feet wide.

According to W. H. Storms[1] the average expense of mining and milling here was about $3 a ton in 1900. The mill contained 40 stamps, weighing about 800 lbs. each and crushing four tons each daily through No. 16 brass wire screen; finer crushing was said to save a little more free gold, but resulted in greater loss by sliming the concentrate. The free gold was only 35% of that recovered. The sulphides formed 2½% of the ore and contained $100 gold per ton.

The total production must have been over $5,000,000.

Other Small Mines and Prospects.

In the Pine Grove and Pioneer districts there are numerous small mines which show activity during the dry season. In general, these show the same characteristics as those in the larger West Point district, south of Mokelumne River in Calaveras County, of which these districts are geologically a part. The veins usually are narrow, the ore is high grade but as a rule pockety. Below the oxidized zone, in which many pockets have been found, sulphide ore, which is often complex comes in. Among these properties may be mentioned the following:

Amador Columbus and *West Columbus*. Equipped.

Columbus No. 3 and a number of others belonging to the same owners were being prospected in 1926.

Crammer Mine. Lately under option.

Dane-Mitchell Mine. Recently active. A former producer.

Haverly Bros. Mine. Lately under option to A. G. Fraser, Los Angeles.

Spagnoli Mine. Formerly a producer of pockets, one of $16,000 having been found. Three men are prospecting.

[1] Cal. State Mining Bureau, Bulletin 18, pp. 45–49.

TABLE OF QUARTZ MINES AND PROSPECTS, AMADOR COUNTY.

Name of mine	Location			*Owner's name, address	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
A and B	14, 13	7 N.	10 E.	Mrs. Maggie Reaves, 1316 Eighteenth St., Sacramento; John C. Reaves, Plymouth, agent	1,050	13	XIV, p. 14.
Acme	11	7 N.	10 E.	Acme Mining Co.	2,750	....	XIII, p. 66; XIV, p. 14.
Acme Coal et al	9	5 N.	11 E.	Mat. and Edw. Muldoon, Jackson	.....	72	
Aetna	....	....	....	.....	.....	.....	See Amador Gold.
Albany	....	....	....	.....	.....	.....	See Middle Bar.
Allison	....	....	....	.....	.....	.....	See Tripp.
Allison	33	8 N.	10 E.	State of California	1,000	20	XIII, p. 66; XIV, p. 14.
Alma	28	6 N.	11 E.	Alma Mining Co., F. C. Siege Estate, H. Paulson, Secy., 432 Battery St., San Francisco; John B. Frances, Jackson, agent	1,500	150	XII, p. 70; XIII, pp. 66-67; XIV, pp. 14-15.
Alpha	....	....	....	.....	.....	.....	See West Eureka.
Alpha	34, 35	6 N.	11 E.	W. H. Taylor, Jackson	.....	19	
Alpine	2	7 N.	10 E.	Alpine Mining Co., Box 43, Menlo Park	1,100	12	XIII, p. 67; XIV, p. 15.
Amador Columbus	....	....	....	F. L. Henson, 251 Kearny St., San Francisco	.....	....	XX, p. 75.
Amador Core	....	....	....	.....	.....	.....	See Old Eureka.
Amador Gold and Amador Queen Nos. 1 and 2, Aetna, Schoolhouse et al	34	6 N.	11 E.	W. J. McGee, Jackson	1,000	167	IX, pp. 88-93; X, pp. 102-103; XII, p. 71; XIII, p. 72; XIV, p. 15; Bull. 18, p. 44.
Amador King	23	8 N.	10 E.	A. Brown, H. A. Meyers, T. Levaggi, Plymouth.	900	407	XIV, p. 15; Bull. 18, p. 86.
Amador Queen No. 2	34, 35	6 N.	11 E.	Amador Improvement Co., Mission and Twenty-second St., San Francisco	1,000	60	VIII, pp. 91-93; X, p. 107; XII, p. 71; XIV, p. 16; Bull. 18, p. 44.
Amador Star	23	8 N.	10 E.	Henry Kaiser, 1443 S. San Joaquin St., Stockton	.....	130	
Ama Oro	22	7 N.	12 E.	Ama Oro Mining Co., 204 Westbank Bldg., San Francisco	2,440	90	XIV, pp. 15-16.
Anderson	....	....	....	.....	.....	.....	See New York.
Anita	28	6 N.	11 E.	Anita Mining Co., 407 Montgomery St., San Francisco	1,150	44	XIII, p. 68; XIV, p. 16.
Argonaut	17, 20	6 N.	11 E.	Argonaut Mining Co., 404 Humboldt Bank Bldg., San Francisco	1,550	78	XIII, p. 68; XIV, pp. 17-19; XVII, pp. 406-408; XVIII, p. 298; XIX, pp. 13-14; XX, pp. 2, 177; Pre. Rep. 8, pp. 23-24; Bull. 18, pp. 50-52.

Astoria							See Middle Bar Group.
Atlantic	13, 14	7 N.	10 E.	Mrs. Anna Bona, Sutter Creek		15	
Aurora				(See Jose Gulch.)			
Australian							See White.
Azula							Bull. 18, p. 86.
Babcock	22	7 N.	12 E.	F. Devencenzi and F. Garibaldi, Volcano			
Badger							See Old Eureka.
Baliol	5	6 N.	11 E.		1,200		Bull. 18, pp. 75-76.
Ballard	23	8 N.	10 E.	Mrs. John Ballard, 1917 Baker St., San Francisco	1,000	160	
Bay State	23	8 N.	10 E.	Stockton Savings Bank, Stockton, Levaggi Est. Co., Plymouth, agents	1,000	80	XI, p. 146; XII, p. 71; XIII, p. 69; XIV, pp. 19-20; Bull. 18, pp. 85-86.
Belding							See Contention.
Bellwether	21	6 N.	11 E.	(Now part of Kennedy Mine)	1,180		X, pp. 104-105; XI, p. 141, XII, p. 71; XIII, p. 69.
Belmont	32	7 N.	13 E.	Frank Seulberger, John McKelvey, Oakland Savings Bank Bldg., 418 Fourteenth St., Oakland	2,400	15	XIV, p. 20.
Belmont	32	7 N.	13 E.	J. J. Hall, J. B. Grillo, Volcano			VIII, pp. 73-75; IX, p. 143; XI, p. 143; XII, p. 71; XIII, p. 69; XIV, pp. 48-49; Bull. 18, p. 76.
Brenardis							XIII, p. 69.
Black Hill							See Loyal Lode.
Blue Lakes							VIII, p. 97.
Boro	24	7 N.	10 E.	Charles Boro, Drytown			
Bona Fortuna	25	7 N.	10 E.	Dr. Thos. Boydson's Estate, Plymouth, ½; Fremont Mining Co., ½		20	
Bright	28	6 N.	11 E.	Anita G. Mining Co., Jackson		45	
Brown				See Jose Gulch.			
Bruce	14	7 N.	10 E.	Estate of P. B. Cornwall, 128 Sutter St., San Francisco, c/o Colwell, Cornwall and Banker		17	
Bunker Hill, Mayflower and Nevada	25, 36	7 N.	10 E.	J. W. Bullock, Seattle, Wash		76	VIII, pp. 57-63; X, p. 75; XI, p. 79; XII, p. 79; XIII, p. 77; XIV, pp. 20-21; XVII, pp. 408-409; XVIII, pp. 298-299; XIX, pp. 2, 15; XX, p. 2; Pre. Rep. 8, p. 24.
Burlington	4	6 N.	11 E.	Dr. Espy L. Smith, c/o Illinois Merch. Trust Co., 3122 Washington blvd., Chicago, Ill		150	
Butte							Bull. 18, p. 45.
Caledonia	1	7 N.	12 E.	Parket Mining Co., Tracy	2,850	60	XIV, p. 23.
California et al	23, 24	7 N.	10 E.	W. F. Detert, 995 Market st., San Francisco			

*Ownership given in this table is that shown in the county tax records.

TABLE OF QUARTZ MINES AND PROSPECTS, AMADOR COUNTY—Continued.

Name of mine	Location			*Owner's name, address	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Casco							See Hardenberg.
Caucasian Cons	23	8 N.	10 E.	Wm. J. McGee, Sutter Creek			X, p. 120.
Centennial							Bull 18, p. 82.
Central Eureka (including Old Eureka)	7, 8	6 N.	11 E.	Central Eureka Mining Co., 519 California St., San Francisco		182	VIII, p. 49; X, p. 104; XI, p. 144; XII, p. 79; XIII, pp. 69-70; XIV, p. 24; XVII, pp. 409-410; XVIII, p. 299; XIX, p. 2, 15; XX, p. 2; Bull. 18, pp. 64-65; Pre. Rep. 8, p. 24.
Chief et al	14	7 N.	10 E.	Estate of Dr. Thos. Boydson, Plymouth			
Chili Jim	24	7 N.	10 E.	W. F. Detert, 3/5, P. B. Cornwall Estate, 2/5			
Clinton Cons	9	6 N.	12 E.	Charles Wieland, San Francisco	2,700	320	XI, pp. 142-143; XII, p. 72, XIII, p. 78; XIV, p. 26.
Clough							See Reward
Clyde	17, 20	6 N.	11 E.				X, pp. 110-111
Colorado							See Ivate Gray.
Columbus No. 3				S. A. Eastburn & DuBoise, Volcano			
Comet	6	6 N.	11 E.	Mary Baumhardt and Helen Agen, c/o Mrs. H. Agen, R. F. D. C-152-A, Modesto	1,200	7	X, p. 114; XIV, p. 26
Contentson				Thomas Severus, West Point			XIII, p. 70, XIV, p. 26
Cons. McNamara	3	5 N.	11 E.	Mother Lode Mining Co., c/o L. Newman, 272 O'Farrell St., San Francisco			
Cooper	26	8 N.	11 E.	Mrs. Gehn, Des Moines, Iowa			
Cosmopolitan, Dry Creek, Henry Clay	14	7 N.	10 E.	C. T. Crocker, c/o K. F. Crocker, 55 Garnet St., Fitchburg, Mass.	900	100	Field Report.
Crannas	10	5 N.	11 E.	Chas. A. McKinney, Jackson		9	
Creek Lodge	35	8 N.	10 E.	Webb Smith, Jackson, et al.	1,000	160	XIV, p. 27.
Croesus and St. Martin	26	8 N.	10 E.	Estate of Martin Snable, c/o Levagge Estate Co., Plymouth		39	
Crown							See Jose Gulch.
Crown Point				Crown Point Mining Co., Oakland			XII, p. 92; XIII, p. 70; XIV, p. 27.
Crown Point	22, 23	7 N.	10 E.	Mary E. Fontenrose, Jackson			

Dane & Mitchell	33	7 N.	12 E.	Dane-Mitchell Mining Co.	2,400	23	XIII, p. 70; XIV, p. 27.
Defender	29, 32	7 N.	13 E.	West Point Cons. Mines, Inc., c/o V. M. Airola, Madera	2,850	80	XIV, p. 27; XX, p. 75; Pre. Rep. 8, p. 24.
Douglas	28	7 N.	12 E.	Mrs. S. E. McLaine, 2222 Washington St., San Francisco			
Dowling	27, 28	6 N.	11 E.	South Jackson Mining Co., Jackson		8	
Downs	13	7 N.	12 E.	C. R. Downs, Sutter Creek	2,400	17	VI, pp. 20-21; XII, p. 72; XIII, p. 70; XIV, p. 27.
Doyle	34	6 N.	11 E.	Mrs. Catherine Doyle, Jackson	975	18	X, p. 107; XII, p. 72; XIII, p. 70; XIV, p. 27.
Drytown Cons.	22, 23	7 N.	10 E.				X, p. 116.
East Eureka	7, 8	6 N.	11 E.	L. A. Poundstone, Grimes	1,500	45	X, p. 72; XII, p. 71; XIII, p. 67; XIV, p. 28; Bull. 18, p. 63.
East Keystone							See Keystone.
Easton							See Shenandoah.
Ebelbrau	23	8 N.	11 E.	Frank Treganza, 3981 Third Ave., Sacramento		20	
Eclipse	36	7 N.	10 E.	(Now Original Amador)			X, p. 114.
El Dorado	36	7 N.	10 E.	T. C. Mayon, 1531 Market St., Oakland, et al.	900	13	X, p. 99; XIV, p. 27.
	31	7 N.	11 E.				
Elephantine							See Middle Bar Group.
Elkhorn	28	7 N.	13 E.	John and James Grillo, Volcano		19	
Enoch	33, 34	7 N.	12 E.	E. A. Trask, Pine Grove	2,400	25	XIV, p. 28.
Eureka	7, 8	6 N.	11 E.	Central Eureka Mining Co., 519 California St., San Francisco	1,200		X, p. 72; XIII, p. 67; XIV, p. 28; see Old Eureka.
Evans							XII, p. 78; XIII, p. 70.
Excelsior	23	8 N.	10 E.	Gertrude V. Clark, Sutter Creek		20	
Excelsior	25	7 N.	10 E.	J. W. Bullock, Seattle, Wash.	1,350	22	XIV, p. 28.
	30	7 N.	11 E.				
Extension	11	7 N.	10 E.	L. L. Rich, 136 Liberty St., New York, et al.		17	
Farrell	15	5 N.	11 E.	Estate of Rose Rosenberg, c/o Joe Rosenberg, 215 Bacon Bldg., Oakland	600	9	X, pp. 107-108; XII, p. 72; XIII, p. 70; XIV, p. 288.
Florence	4	6 N.	12 E.	Edm. B. Dennison, c/o Mrs. F. Dennison, 1547 Clay St., San Francisco		12	
Fort John	11	7 N.	10 E.	E. Rose, c/o E. S. McCurdy, 575 Mills Bldg., San Francisco			
Focus	33	7 N.	12 E.	Knight and Co., Sutter Creek	2,600	25	XIII, p. 70; XIV, p. 28.
Forty-Nine	14	7 N.	10 E.	E. S. Barney, Hayward		19	X, p. 122.
Free American							Bull. 18, pp. 76-77.

*Ownership given in this table is that shown in the county tax records.

TABLE OF QUARTZ MINES AND PROSPECTS, AMADOR COUNTY Continued.

Name of mine	Location			*Owner's name, address	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Fremont	25	7 N.	10 E.	Fremont Cons. Mining Co., 24 Market St., San Francisco	1,000	150	VIII, p. 53; X, p. 75; XI, p. 146; XII, p. 72; XIII, p. 71; XIV, pp. 28-29; XVII, p. 411; XVIII, p. 299; XIX, pp. 15, 73, 143; XX, p. 2, Pre. Rep. 8, p. 24; Bull. 18, pp. 80-81
Gillett	34	8 N.	11 E.		1,800	10	
Golden Crown	18	7 N.	11 E.	c/o Herman Wedler, 2330 Myrtle St., Oakland		23	
Golden Eagle, Tramway	6	6 N.	11 E.	C. R. Downs, Sutter Creek			X, pp. 113-114
Golden Gate	14	7 N.	10 E.	John F. Davis, Humboldt Bank Bldg., San Francisco		20	
Golden Gate	14	8 N.	10 E.	Chas. Kretcher, R.F.D. 1, box 36, Placerville, ½; W. F. Detert, 995 Market St., San Francisco, ½		17	
Golden Gate	12, 13	7 N.	12 E.	Mrs. I. Cassinelli, Volcano		12	
Gold Mountain	19	7 N.	11 E.	Gold Mountain Mining Co., 1231 Jones St., San Francisco	1,300	20	VIII, p. 94; XI, p. 145; XII, p. 72; XIII, p. 71.
Good Hope	28	6 N.	11 E.	C. P. Vieira, Jackson, et al.; Good Hope Mining Co., c/o J. F. Davis, Humboldt Bank Bldg., San Francisco	1,100	40	XIII, p. 71; XIV, p. 29.
Gover	25	7 N.	10 E.				VIII, pp. 53-57; X, p. 75; XI, p. 146; XII, pp. 72-74; XIII, p. 71.
Gowanas							Bull. 18, p. 85.
Gracey Mill							XIII, p. 71.
Grand Prize	32	8 N.	13 E.	George Andrews, P.O. Box 246, New Liskeard, Ontario	2,500	19	XIV, p. 29
Great Eastern	23	8 N.	10 E.	Great Eastern Mining Co., c/o Elmer Tripp, Plymouth		14	
Grey Eagle	2	7 N.	10 E.	O. Ball, Plymouth		8	
Gulesta							See Belmont
Hagerman							XVIII, p. 7.
Hardenburg	10	5 N.	11 E.	Wm. J. and Ralph McGee, Sutter Creek	825	45	X, pp. 68, 106-107; XI, pp. 139-140; XII, p. 74; XIII, p. 71; XIV, pp. 29-30.
	3	6 N.	11 E.				

Harding							See Madrona.
Hazard							See Treasure.
Hercules	14	7 N.	10 E.	Chas. H. Shields, Plymouth		16	
Hector							VIII, p. 73; XI, p. 145.
Hollywood							See New Albany Cons.
Honolulu Lady	33	7 N.	13 E.	Bow Ridge Development Co., c/o Eben Putman Box 3077, Boston, Mass			
Idaho, Jr.							See Excelsior.
Illinois, Green, et al	35	8 N.	10 E.	Estate of Dr. T. Boydson, Plymouth		48	X, p. 119.
Irma				L. Casinelli, Volcano			XII, p. 74; XIII, p. 71; XIV, p. 30.
Irma and Weldon	22	7 N.	10 E.	B. I. Hoxie Estate, Drytown			
Isaac Newton	36	6 N.	11 E.	Gustave Bowman, New York City, 9/10; c/o I. Everett, Mokelumne Hill	1,100	49	XIV, p. 30.
Italian	24	7 N.	10 E.	Ginocchio Brothers, Jackson		2	X, pp. 115-116.
Ivanhoe				S. C. Wheeler, Plymouth			XIII, p. 71; XIV, p. 30; Bull. 18, p. 84.
Jackson Gate							XIII, pp. 71-72.
Jackson Gold Fields Co.							See Amador Gold and Amador Queen.
Jackson G. M. and M. Co.	Lot 39	Block 10	Jackson	c/o A. Peters, Angels Camp			
Jose Gulch (Brown, Aurora et al.)	2	5 N.	11 E.	Jose Gulch Mining Co., c/o Mary J. Maybourne, Emeryville	1,000	86	XIV, p. 30.
	35	6 N.	11 E.				
Jupiter	21, 22	8 N.	11 E.	M. E. Gates, 2841 Filbert St., San Francisco		19	
Kate Gray				W. Q. Mason, Pioneer			XIII, p. 72; XIV, p. 30.
Katherine and Adeline	32	7 N.	13 E.	Douglas Keith, Berkeley	2,400	40	XIV, p. 30.
Kelly	3	5 N.	11 E.	C. P. Vicini, Jackson	850	40	X, p. 108; XII, p. 74; XIII, p. 72; XIV, p. 30.
Kelly				Frank Kelly, Volcano			XIII, p. 72; XIV, p. 30.
Kennedy	16, 17	6 N.	11 E.	Kennedy Mining and Milling Co., 409 Montgomery St., San Francisco	1,500	156	VIII, pp. 66-71; X, pp. 103-104; XI, pp. 141-142; XII, pp. 74,77; XIII, p. 72; XIV, pp. 31-34; XVII, p. 408; XVIII, p. 299; XIX, p. 15; XX, pp. 2-3; 177; Bull. 18, pp. 52, 60.
	20, 21	6 N.	11 E.				
Kennedy Extension	20	6 N.	11 E.	Kennedy Extension Gold Mining Co., 419 Sheldon Bldg., San Francisco	1,450	54	Field Reports.
Keystone	36	7 N.	10 E.	Keystone Mining Co., c/o C. L. Culbert, Secy., Jackson	1,100	123	VI, pt. 2, pp. 16-17; VIII, pp. 63-66; X, p. 98, 72, 73; XI, p. 145; XII, p. 77; XIII, p. 72; XIV, pp. 34-35; XVII, p. 411; Bull. 18, p. 77.
	19, 20	7 N.	13 E.				
Kimball	21, 28	7 N.	13 E.	A. F. Kimball, Volcano	3,300	80	XIV, p. 36.
	29, 30	7 N.	13 E.				

*Ownership given in this table is that shown in the county tax records.

TABLE OF QUARTZ MINES AND PROSPECTS, AMADOR COUNTY—Continued.

Name of mine	Location			*Owner's name, address	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Kirkwood							Bull. 18, p. 45
Kruger and Vaughn (Lots 55 and 59)	3	5 N.	11 E.	F. and J. Champion, 468 Rich St., Oakland		40	X, p. 107
Lady Bedford	14	8 N.	10 E.	E. Steel, ½, c/o G. M. Steel, Lodi; ½ to Williams, Strange and Smith, 309 S. School St., Lodi		14	
Last Chance	36	7 N.	10 E.	J. W. Bullock, Seattle, Wash. (Consolidated with Original Amador)	1,200		X, p. 115
Levaggi	27	7 N.	13 E.	Levaggi Estate Co., J. Esola, West Point, agent	2,150	80	XIV, p. 36
Lincoln Cons.	6, 7, 8	6 N.	11 E.	Lincoln Cons. Mining Co., Sutter Creek	1,200	380	VIII, p. 73, 75-79; IX, pp. 73, 75-78; X, pp. 100, 101-102, XI, p. 144; XII, pp. 79-80, XIII, pp. 73-74, 78-79, XIV, pp. 36-37
Little Amador	36	7 N.	10 E.				XIII, pp. 72-73
Littlefield							New Albany Cons.
Little Illinois	23	7 N.	10 E.	J. H. Thomas Estate, Drytown	800	36	XIV, p. 37.
Little Sargent	10	5 N.	11 E.	Estate of A. Caminetti, Jackson			
Live Oak	14	7 N.	12 E.		2,300		VIII, pp. 79-80
Lone Willow Group	21	7 N.	13 E.	Charles Gruney, Pioneer	2,800	60	XIV, p. 37
Lucas (or Logal Lode)				Now part of Fremont Mine			VIII, pp. 51-53; XIII, p. 73
Lucas				Plymouth Cons. Gold Mines			VIII, pp. 49-51; X, pp. 117-118; XII, p. 78, XIV, p. 37; XIII, p. 73
Lucky Strike et al.	Pioneer Sta.			Mrs. Louise Casanelli, Volcano, c/o L. L. Patrick			
Madrona Group	20, 21	7 N.	13 E.	L. Casanelli, Volcano	2,900	140	XII, p. 78; XIII, p. 73; XIV, pp. 37-38
Mahoney				(Part of Lincoln Consolidated)			VIII, p. 73; X, p. 72; XII, p. 78, Bull. 18, pp. 65-71.
Mammoth	10	5 N.	11 E.	F. W. Patterson Estate, Fresno; Alex. Chalmers, Angris, agent, Federal Dev. Co., c/o S. I. Jones, 176 Townsend St., San Francisco	650	26	VI, pt. 2, pp. 21-22; VIII, pp. 93-94; X, p. 119, XI, p. 67, XII, p. 78, XIII, p. 74; XIV, p. 38, XIX, p. 143
Mammoth	3	6 N.	12 E.	Mammoth Mining Co., c/o J. H. Kirby, Ukiah, Grove		20	

Marklee	1	7 N.	12 E.	Marklee Mining Co., c/o W. H. Bley, 712 Ohio St., Vallejo	3,020	80	XIII, p. 74; XIV, p. 38; XX, pp. 3, 73-74.
Maryland	24	7 N.	10 E.	Estate of P. B. Cornwall, 128 Sutter St., San Francisco		13	
Massa							See Jackson Gate.
May Ella	11	7 N.	10 E.	C. H. Shields and S. Wilds, Plymouth		18	
Mayflower							XII, p. 78; XIII, p. 74.
McIntyre	6	6 N.	11 E.	John A. McIntire, 1530 O St., Sacramento	1,100	24	X, p. 115; XIII, p. 74; XIV, p. 38.
McKinney and Crannis	10, 15	5 N.	11 E.				X, p. 106.
Mechanics	4, 5 32, 33	6 N. 7 N.	11 E. 11 E.	Wm. J. McGee and Trustees, Sutter Creek		14	X, p. 112; XIII, p. 74; XIV, p. 38; Bull. 18, p. 76.
Medean				Keystone Mining Co.			See South Spring Hill.
Meehan Cons	10	5 N.	11 E.	W. Gibbert, J. Strohm, M. C. Fontenrose, Jackson		24	
Meek							See Evans.
Middle Bar							See New Albany Cons.
Middle Bar Q. M	10	5 N.	11 E.	Mrs. J. and G. Turcinovich et al., Jackson			
Middle Bar Group	3, 10 15	5 N. 5 N.	11 E. 11 E.	Mrs. Lena Glavinich and M. Thomas	700	80	X, pp. 108-109; XIV, p. 38
Midway and Esmeralda	21, 22	7 N.	13 E.	W. Q. Mason, Pioneer	2,800	40	XIV, p. 38.
Mineral Point	3	5 N.	11 E.	H. E. Furman, Sutter Creek, et al		9	
Modoc				Mace Co., Ione			XIII, p. 74; XIV, p. 38.
Monterichard	30	6 N.	11 E.	Pacific Gas and Electric Co., San Francisco		20	
Monte de Oro	26, 35	8 N.	10 E.	c/o Levaggi Estate Co., Plymouth	1,000	147	XIV, p. 38.
Monitor	14	7 N.	10 E.	Charles H. Shields, Plymouth		7	
Moore	34, 33	6 N.	11 E.	Moore Mining Co., San Francisco; Central Land Co., c/o Alex Chalmers, Agent, cor. Park Way and Monte Ave., Piedmont	1,125	200	VI, pt. 2, p. 20; VIII, pp. 84-85; XII, p. 78; XIII, p. 74; XIV, p. 38; XVIII, pp. 299-300; XIX, pp. 15-16; XX, pp. 3, 74, 177; Pre. Rep. 8, p. 24.
Moar Brothers							See Lucky Strike.
Morley							See Middle Bar Group.
Mountain King	4	6 N.	12 E.	W. B. Pitts and Mrs. Louise Pitts, Pine Grove	2,600		XIV, pp. 38-39 (See Pitts).
Murray, Vaughn, Kruger				See Kruger			X, p. 107.
Mutual	6	6 N.	11 E.		1,300		Bull. 18, pp. 74-75.
Nevill							See Mammoth Mine.
New Albany	10, 15	5 N.	11 E.	New Albany Cons. Gold Mining Co., Martin Jones, San Francisco, agent	600	100	XII, p. 78; XIII, pp. 74-75; XIV, p. 39.

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TABLE OF QUARTZ MINES AND PROSPECTS, AMADOR COUNTY—Continued.

Name of mine	Location			Owner's name, address	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
New Hope	3	7 N.	10 E.	Mrs. E. Adams, Plymouth		8	X, p. 121.
New London							See Lucille.
Newman				L. Brewster, V. Fyke, W. C. Lucas, Plymouth			
New York	6	5 N.	11 E.	G. W. Anderson Estate, Stockton			X, p. 123; XI, pp. 140-141; XII, p. 78; XIV, p. 39; XIII, p. 75; Bull. 18, pp. 44-45.
North Coaver	25	7 N.	10 E.	(Part of Fremont Mine)			X, pp. 116-117; XIII, p. 75.
North Star	6	6 N.	11 E.	South Keystone Mining Co., c/o Wm. Fergis, Tacoma	1,300	8	VIII, pp. 71-72; X, p. 99; XII, p. 78; XIII, p. 75; XIV, p. 39.
Nugget							Bull. 18, p. 86.
Occidental	6	6 N.	11 E.				X, p. 115.
No. 1 and No. 2	5, 8	6 N.	11 E.	L. R. Poundstone, Grimes		38	
Old Eureka, Tanner Tunnel, Alpha Mining Co.	8	6 N.	11 E.	Central Eureka Mining Co.	1,200	111	X, pp. 72, 102; 113; XI, p. 144; XIII, p. 67; XIV, p. 28; XVII, p. 411; XIX, p. 73; XX, pp. 3, 74; Pre. Rep. 8, p. 24.
Old Oaker	4	7 N.	10 E.	Southerland and Southerland, c/o H. Hurd, 1st Nat'l Bank Bldg., Roswell, New Mexico		17	
Olsta Gold Mining and Milling Co.							See Smith-Vincent.
Oneida	17	6 N.	11 E.	South Eureka Mining and Milling Co., 708 Alaska Commercial Bldg., San Francisco	1,300	283	VIII, p. 79; X, pp. 109-110, XII, p. 78; XIII, p. 75; XIV, p. 39; Bull. 18, pp. 60-63.
Ore Grande et al	29, 32, 33	7 N.	13 E.	Oscar Isefstad, 231 Pine St., San Francisco		33	
Original Accident	36	7 N.	10 E.	J. W. Bullock, Seattle, Wash.	1,050		VIII, p. 42; X, p. 114; XII, p. 78; XIV, pp. 39-40; XX, p. 3.
Osceola	14	8 N.	10 E.	Osceola Mining Co., c/o Durrand Co., 521 Clay St., San Francisco		120	
Pacific							See Plymouth Cons.
Parker	14	7 N.	12 E.	J. Eagen, 1026 Pierce St., San Francisco		21	
Peerless							Bull. 18, p. 45.
Peerless, Comber, Homestake	24	7 N.	10 E.	Seaton Mining Co., c/o H. A. Myers, Plymouth		9	See Seaton.

Penavita et al	11, 12	7 N.	13 E.	Arthur Berg, Volcano	3,000	20	XIV, p. 41.
Penolay Ranch							XIX, p. 300.
Penston	25	8 N.	9 W.	E. R. Walker, 1628 Gower St., Los Angeles		17	
Philadelphia	14	8 N.	10 E.	J. J. Crawford, Humboldt Bank Bldg., San Francisco, et al	1,000	140	XII, p. 78; XIII, p. 75; XIV, p. 41; Bull. 18, p. 84.
Piney Creek							XX, p. 75.
Pioneer	14	7 N.	10 E.	Estate of Dr. Thomas Boydson, Plymouth	1,100	20	VIII, p. 42; X, p. 112; XII, pp. 78-79; XIII, p. 75; XIV, p. 41; Bull. 18, pp. 83-84.
Pioneer				Moar Bros., Lessees, Pioneer Station			
Pioneer							See Argonaut.
Pitts	4	6 N.	12 E.	W. B. Pitts and Mrs. Louise Pitts, Pine Grove		139	XIV, p. 38; XX, pp. 74-75.
Plymouth Cons	11	7 N.	10 E.	Argonaut Mining Co., Humboldt Bank Bldg., San Francisco	1,100	156	VI, pt. 2, pp. 15-16; VIII, pp. 42-49; X, p. 117; XI, p. 79; XII, p. 79; XIII, p. 75; XIV, pp. 37, 41-43; XVII, p. 411; XVIII, p. 301; XIX, pp. 16, 73; XX, pp. 3, 177; Pre. Rep. 8, p. 24; Bull. 18, pp. 82-83.
Plymouth-Eureka	3	7 N.	10 E.	c/o J. Ninis, Plymouth	1,050	40	XIV, p. 43.
Plymouth Rock	10	7 N.	10 E.	Isaac W. Winans, Plymouth		20	
Pocahontas	23, 24	4 N.	10 E.	W. F. Detert, San Francisco, and Alleny McWayne, Drytown	900	46	X, pp. 122-123; XIV, p. 44; Bull. 18, p. 83.
Potazuba							See Mechanics.
Price	26	8 N.	10 E.	J. H. Durst and C. C. Castle, also assessed to W. L. Phillips, West Point		20	X, pp. 120-121.
Queen							Bull. 18, p. 87.
Red Cloud	33	8 N.	10 E.	Glanch Bros., Oleta, et al., and A. Perovich, Jackson			X, pp. 119-120; XIII, pp. 75-76; XIV, p. 45; Bull. 18, p. 85.
Red Crown	34	6 N.	11 E.	Estate of Wm. Moon, Jackson			
Red Oak	11	7 N.	10 E.				X, p. 121.
Red Tape	23	7 N.	13 E.	Oscar Lofstead, Defender	2,200	50	XIV, p. 45.
Reward	34	7 N.	12 E.	Hilda Clough, Pine Grove	2,250	43	XIII, p. 76; XIV, p. 45.
Rhetta							See Amador King.
Richmond							See Philadelphia.
Robinson							See Acme.
Robinson	2	7 N.	12 E.		2,500		XIII, p. 76.
Sargent and Marlette	10	5 N.	11 E.	Mrs. Julia Sargent, Jackson	650	193	X, p. 107; XIV, p. 45.
Seaton	24	7 N.	10 E.	Seaton Mining Co., c/o H. A. Myers, Plymouth	1,000	20	VIII, p. 42; XIII, p. 78; XIV, p. 45.
Shakespeare	11	7 N.	10 E.				X, pp. 121-122.

*Ownership given in this table is that shown in the county tax records.

TABLE OF QUARTZ MINES AND PROSPECTS, AMADOR COUNTY Continued.

Name of mine	Location			Owner's name, address	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Shenandoah	35	8 N	10 E.	Mrs. Hilda Brown, New York City	1,190	80	XIII, p. 70; XIV, p. 45; Bull. 18, p. 84.
Smith Vanoni	34	8 N	11 E.	Lewis Smith, Oleta, owner; Oleta Gold Mining and Milling Co., operating company in 1926.	2,000		XX, p. 3.
Somerset et al				Defender Development Co., c/o J. B. Joyce, Volcano			
South Cosmopolitan Group	24	7 N	10 E.		925		VIII, p. 49.
South Eureka	17, 8	6 N	11 E.	South Eureka Mining and Milling Co., 354 Pine St., San Francisco.	1,700	131	X, p. 113; XI, p. 144; XII, p. 79; XIII, pp. 76-77; XIV, pp. 45-47; Bull. 18, pp. 63-64.
South Jackson	28, 34	6 N	11 E.	South Jackson Mining Co., Jackson; J. Schweitzer, Secy., 3600 Clay St., San Francisco.	1,400	70	XIV, pp. 47-48.
South Keystone	6	6 N	11 E.	Mrs. B. C. Clark, Sutter Creek, ¾; J. A. McIntire, Sacramento, ¼			X, p. 115; Bull. 18, p. 77.
South Mayflower							See Bunker Hill.
South Spring Hill (including Medeam and Talisman)	31	7 N	11 E.	Keystone Mining Co., c/o C. L. Culbert, Secretary, Jackson	1,100	38	VI, p. 18; VIII, p. 71; 80-84; X, pp. 73, 98, 99; XI, p. 145; XII, p. 79; XIII, pp. 74, 77; XIV, p. 48; Bull. 18, p. 77.
Spagnoli	9	6 N	12 E.	Ernest Krentz, Valley Springs			Bull. 18, p. 45.
Stewart				(Now part of Lincoln Cons.)			VI, p. 19; XII, p. 79.
Stukel	9	6 N	12 E.	Mrs. S. W. Steele, 30 E. San Fernando St., San Jose		20	
St. George				Thomas George, Plymouth, et al.			XIII, p. 77; XIV, p. 48.
St. Julian	10	5 N	11 E.	Bank of Amador County, Jackson	900	12	XIII, p. 77; XIV, p. 48.
Strong							XIII, p. 77.
Summit				Central Eureka Mining Co.			See Central Eureka.
Sunset	9	5 N	11 E.	John Ratto, Sutter Creek; Sierra Metals Corporation, operating, 701 Crocker Bldg., San Francisco.			XX, p. 75.
Sutter Creek							See Belmont.
Talisman				Keystone Mining Co.			See South Spring Hill.

Telegraph Hill							XIII, p. 77.
Tellurium	33	7 N.	12 E.	W. S. Straub, Oakland	2,400	20	XII, p. 79; XIII, p. 77; XIV, p. 49.
Tierakoff	32	7 N.	13 E.	W. A. Marchand, Defender			XII, p. 92; XIII, p. 77; XIV, p. 49.
Treadwell							See Belmont.
Treasure	25	7 N.	10 E.	Treasure Mining Co., Corp., 575 Mills Bldg., San Francisco; E. S. McCurdy, Secretary	1,000	22	XIII, pp. 77-78; XIV, pp. 49-50; XVII, pp. 411-412; XVIII, p. 300; XIX, p. 16.
Tripp	10	5 N.	11 E.	H. T. Tripp, Jackson			XIII, p. 78.
Triumph	6	6 N.	11 E.	C. R. Downs, Sutter Creek			See Golden Eagle.
Union Cons							See Clinton Cons.
Valparaiso	10	5 N.	11 E.	D. Boro, E. Garibaldi, Jackson, et al., Valparaiso Mining Co., Jackson	980	36	VIII, p. 42; XII, p. 79; XIII, p. 78; XIV, p. 52.
Velvet				Charles Hagberg			
Victoria	11, 24	7 N.	10 E.	John Dixon, c/o R. D. Dixon, 425 Fourth St., Santa Rosa		20	
Volunteer							X, p. 105.
Wabash	6	6 N.	11 E.	Wabash Mining Co., c/o Webb Smith, Jackson			
West Eureka	7	6 N.	11 E.	John Ross, E. D. Botta, Sutter Creek, et al.	1,220	15	XIV, p. 52.
West Side							XVIII, p. 301
Wetzler							See Middle Bar Group.
Whitmore							See Ama Oro.
White Mountain	19	7 N.	12 E.	J. P. Treanor, 454 California St., San Francisco		15	
White	21	6 N.	11 E.				X, p. 110.
Wildcat	9	6 N.	11 E.	Chicizola Estate Co., Jackson		60	
Wildman				(Part of Lincoln Consolidated)			VIII, p. 75; X, p. 101; XI, p. 144; XII, p. 80; Bull. 18, pp. 65-71.
Wolverine							XII, p. 80; XIII, p. 79.
Wyomea	2	7 N.	10 E.				X, p. 118.
Yellow Jacket	35	8 N.	10 E.				
Zeile (Zeika)	14	7 N.	10 E.				X, p. 118.
	28	6 N.	11 E.	Kennedy Mining and Milling Co., Clunie Bldg., San Francisco	1,400	260	VI, pp. 22-23; VIII, pp. 22, 68, 85, 88; X, pp. 68, 104; XI, p. 139; XII, p. 80; XIII, p. 79; XIV, p. 52; Bull. 18, pp. 45, 50.
Zumwalt							XII, p. 79; XIII, p. 79.

*Ownership given in this table is that shown in the county tax records

GOLD (PLACER MINES).

Placer mining has become almost a thing of the past in Amador County. The last important operations were between 1904 and 1923, when the *American Dredging Company* operated three gold dredgers on Mokelumne River from Lancha Plana downstream for nine miles. Part of this ground was in Amador County.

The gravel was from six to 35 feet deep, with an average depth of 20 feet, carried a heavy overburden, and lay on the usual lava-ash false bedrock. Two dredgers had buckets of 6-cu. ft. capacity and one had 9-cu. ft. buckets. The smaller dredgers handled usually about 125,000 cubic yards apiece monthly and seemed better adapted to the shallow ground than the larger one. The cost of operation was less than in Oroville and the yield was also lower, averaging under 10 cents a cubic yard. This company had a total of 450 acres of land.



Dredger Field, near Lancha Plana, formerly worked by American Dredging Company.

Recently plans have been made to organize a stock company and build a small dredger to work some land remaining at Lancha Plana.

Hydraulic mining has been on a limited scale in the county in recent years.

Clark Gravel Mine near Oleta has lately been examined, with the possibility of some work being done. Address, Wm. D. Clark and F. M. Clark, Oleta.

Cleveland Placer Claim, adjoining the Elephant on the west, has an adit 2400 feet long and made some production eight years ago, but lately has been idle. Address, F. Garibaldi and F. Devencenzi, Volcano.

Elephant Hydraulic Mine, near Volcano, was worked in 1922-23, and a moderate production was made. The debris restraining dam for this property is nearly filled and little piping has been done for several years. At present the property is in part under lease to Valentine

Giuliani and sons and Chester Bonneau. A little drifting was being done when visited in March, 1927, and a hole in the bedrock was being cleaned out. This mine has sufficient water for piping from about January 1 to the end of the wet season. It has a bedrock cut 125 feet long and about 500 feet of 3 ft. by 3 ft. flume. Address, J. W. Preston, Jr., 350 Post Street, San Francisco.

Leoni Claim, 3½ miles south of Oleta, has lately been prospected by Myers and others of Plymouth. This is a drift prospect.

Loafer Hill Claim has been prospected by Joe Casper, Oleta. It is a drift claim near that place.

Ludekins Hydraulic Mine near Pine Grove has been nearly worked out and lies idle now as water is no longer available.

Union Flat Hydraulic Mine, one-half mile north of the Elephant Mine, still has a few small pieces of gravel left. The lessees of the latter property worked the Union Flat about three weeks this season.

Upton Drift Mine near Oleta was last worked by Charles Crane of Oleta. He was unable to make it pay. The high ground on the rims paid well in this district, but the deeper ground is said to be generally unprofitable.

Wicker Hydraulic Mine near Lancha Plana has been worked on a very small scale by Edgar Ekel for many years.

There are those who claim that considerable good gravel remains unworked in the Oleta and American Hill districts, but there is no authentic record of past operations. Most of the ground worked was drifted in early days, and it is known to have paid well.

In the Defender district there is an unprospected deep channel which at present is on land patented for agricultural purposes. There is a length of perhaps three miles of this, regarding which little is known.

IRON ORE.

Impure hematite, for the most part in small, unimportant bunches, occurs at places on the surface, associated with the Ione formation or as boulders and pebbles in the soil overlying it. The largest such deposit is two miles west of Ione. It has not been developed. Near Clinton, east of Jackson on the road to Pine Grove, iron ore of better grade, said to carry 55% iron, occurs.

LIMESTONE AND MARBLE.

The largest areas of limestone (in part changed to marble) in the county are at Volcano, and 3½ miles northwest of there. The first area is reached by 14 miles of good road from Martel station, but the second is considerably farther from railroad. Neither area has been developed. A great number of comparatively small lenses of limestone occur in the western area of Calaveras schists which extends across the county from Mokelumne River northwest, west of the Mother Lode. The old *Amador County Lime Kiln*, four miles northeast of Ione, was on one of these.

Small marble quarries have been opened near Pine Grove and 2½ miles east of Plymouth. A beautiful red marble and a serpentine

veined by magnesite, forming a stone of the 'verde antique' type, lie undeveloped west of Drytown.

Amador Marble Quarry is 2½ miles east of Plymouth in the canyon of a north fork of Dry Creek. The deposit was opened years ago about 100 feet wide and 100 feet high, but has been idle recently. It is a gray and blue clouded stone. The quarry is about 13 miles from the railroad station of Carbondale. Alessio Dalporto, Plymouth, owner.

Carrara Marble Quarry is about four miles by road northwest of Pine Grove on the south side of the canyon of Sutter Creek, and 12 miles by road from Martell railroad station. A body of white marble, irregularly veined and splotched with blue, has been stripped on the canyon side for a width and height of about 150 feet. The quarry is worked in the dry season by C. Dondero, who ships the stone for use in San Francisco. Blocks of good size are taken out and shipped in the rough state. There is a small derrick and engine for handling the blocks.

Near *Volcano* and adjoining the Elephant hydraulic mine, James Cosgrove, Jackson, has a 20-acre placer claim, and John Rossi of Sutter Creek and other parties have 40 acres covering parts of the large area of limestone and marble near the corner common to Secs. 14, 15, 22 and 23, T. 7 N., R. 12 E. The stone is in places a white marble with tree-like black veining. It forms the bedrock of the old placer diggings and in places the rim of the old channel, and has been deeply guttered by erosion. No work has been done here.

Wait Marble Deposit is three miles west of Drytown and eight miles by road from Carbondale railway station. A hard, durable marble, having a beautiful cherry red color when polished, outcrops near the road over an area of 160 by 400 feet. The surface of the deposit is flat. The only work done has been one drill hole which was put down about three years ago by California Slimes Company, under the direction of W. E. Darrow. This hole is 46 feet deep, and is reported to show the marble all the way and in the bottom.

Near the red marble there is a small outcrop of the 'verde antique' type, serpentine veined by magnesite, on which nothing has been done.

MANGANESE.

During the war period between 1915 and 1919, several manganese prospects were worked on a small scale in this county, and there was some production. There is no record of activity in this line since 1919.

The following properties were mentioned in our Bulletin 76, Manganese and Chromium in California:

Crocker-Preston property is in the SW¼ of Sec. 35, T. 7 N., R. 12 E., M. D. M., a mile and a half south of Volcano, and is owned by M. I. Crocker and J. W. Preston, Jr., 350 Post Street, San Francisco. It is 12 miles from Martel railroad station.

Lenses of manganese ore, some resembling deposits from mineral springs, occur in a mineralized zone at least 100 feet wide on contact between limestone and schist. Good grade ore was found, and some of it was mined.

L. Everett, Mokelumne Hill, reported an undeveloped manganese prospect four miles east of Pine Grove, which is 10 miles from Martel station, by good road.

Lee Peyton and others had a lease in 1918 on a prospect of manganese ore one-half mile north of the Crocker-Preston property, in the NW¼ of Sec. 35. Some ore was mined.

Ruhser & Huberty had a deposit of manganese ore one-half mile southeast of Defender. It was worked by the Manganese Company of California in 1916 and it is reported that 250 tons of ore were shipped that year. Defender is 19 miles from Martel, the nearest railroad point.

Stirnman Ranch. Owner, Mrs. L. E. Blakemore, 401 McDonnell, Ave., Stockton. It is in S½ of SE¼ Sec. 25, T. 7 N., R. 12 E., about 17 miles from Jackson via the Silver Lake road. This manganese prospect has not been visited by a representative of this bureau.

MINERAL PAINT.

At many places overlying the sand and clay of the Ione formation, red and yellow iron oxides occur. Most of this material is red oxide, mixed with more or less clay and sand. Very few places were noted where this material was in quantity sufficient to be of commercial interest or of high enough quality. It is in the form of concretions, on the surface or mixed in the soil.

Some of the piles of chlorination tailings resulting from the treatment of gold-bearing sulphides at mines along the Mother Lode years ago would be suitable for paint.

PLATINUM GROUP METALS.

On the Mokelumne River from near Lancha Plana downstream beyond the westerly county line, considerable dredging has been done and this yielded a little of the platinum group metals. The American Dredging Company operated three dredgers here between 1904 and 1923. The relative proportion of platinum was lower than on other streams farther north. The annual production was 20 to 25 ounces. No analysis of the product could be obtained, but the platinum content was thought to be about 50% and most of the remainder was probably osmiridium. There is no output of these metals now.

SANDSTONE.

O'Neal (Barnett) Sandstone Quarry is in Sec 27, T. 5 N., R. 10 E., 10 miles by road from a point on the railroad near Ione, and a mile south of the Buena Vista and Lancha Plana road.

This quarry was worked 40 years ago and furnished stone for such buildings as the California National Bank, Sacramento, the old Chronicle Building, in San Francisco, and others. It has lain idle a long time. Some activity was promised in 1924, but did not materialize.

The sandstone outcrops for 450 feet in length on top of a hill and is covered by 25 feet of soft white sand and gravel. It is of a pleasing red color. On the east end, a face 100 feet long by 15 feet high was opened in the old work. On the west the face of stone is about 20 feet

high and cross-bedding planes, on which the stone splits, are not nearly as prominent as on the east. Here it has been worked back for 40 feet.

On the west end of the same hill, perhaps 500 feet west of the red beds, is a face of beautiful white sandstone about 100 feet long by 10 feet high, covered by six to 10 feet of gravel. It is softer than the red stone and shows some white mica. There is no equipment at the quarry.

SAN FRANCISCO FIELD DIVISION.

C. McK. LAIZURE, Mining Engineer.

SOLANO COUNTY.

Solano, named after a former chief of the Suisun tribe of Indians, is another of the original twenty-eight counties created by an act of the first legislature in 1850. The only change of importance in its boundary lines was made in 1853 when Mare Island, lying opposite Vallejo, was transferred from Sonoma to Solano County. A few years later some minor changes were made in both the eastern and western line, but with little loss or gain in area. Since 1857 its boundaries have remained as they are today.

Geography.

Radiating in a northeasterly direction from San Pablo Bay, an arm of San Francisco Bay, Solano County is bounded on the west by Napa County, on the north by Yolo, and on the east in part by Yolo and Sacramento. Contra Costa County lies on the south, Sacramento River, Suisun Bay and Carquinez strait forming the dividing line. Solano County contains 822 square miles of land area and its population is 40,602 (1920 census). About 80% of the land is tillable and 20% mountainous and nontillable.

Besides river and ocean transportation facilities, the main line of the Southern Pacific railroad passes through the county, with branches to Sonoma and Napa valleys in adjoining counties. San Francisco-Sacramento Railroad Company's lines (electric) likewise traverse the county and the San Francisco, Napa and Calistoga Electric railway terminates at Vallejo. The latter city is also on a main state highway. Mare Island Navy Yard employs about 5000 men and Vallejo, with a population of 20,000, is the principal industrial city. Fairfield is the county seat.

Grains, fruits, nuts and alfalfa are readily grown and general farming, dairying and stock-raising are important pursuits. Its chief mineral products are cement and miscellaneous stone. Quicksilver is the only metal of commercial value found here, but its mineral resources also include brick, clay, fuller's earth, mineral water, natural gas, onyx and salt. Small amounts of chromite have been noted.

Topography.

Sulphur Springs ridge, Vaca Mountains and Blue Mountains, which the western boundary closely follows from south to north, form the principal mountainous area. Potrero hills and Montezuma hills are isolated high lands along the southern boundary. The remainder of the county is nearly all level valley and delta land. Drainage is to south and east, mainly through Putah creek and Suisun creek into Sacramento River.

Geology.

The belt of Cretaceous sandstones and shales bordering Sacramento Valley on the west terminates at the south near Fairfield. This formation occupies the hilly northwest corner of the county. There is another small area of the Cretaceous in the range of hills north of

Vallejo and Benicia. Sedimentary beds of Tertiary age flank this area on the north and east and also appear in the hills southeast of Fairfield. Extending north from Benicia, passing west of Fairfield and thence swinging west into Napa Valley the ridges are capped with a lava flow, probably of late Tertiary age. The rest of the county is covered with Recent alluvium; unconsolidated sands, gravels and clays, characteristic of the great valley floor.

MINERAL RESOURCES.

Solano first entered the list of mineral producing counties in 1860 with a natural hydraulic cement rock mined near Benicia. In 1873 the production of quicksilver began at the St. Johns Quicksilver Mine and this property has remained active at intervals up to 1923. It was not, however, until 1900, when the production of portland cement began, that the value of its mineral production exceeded a few thousands of dollars annually. From 1900 to 1925, inclusive, the county has produced more than $1,000,000 annually, giving a total output from 1873 to 1925, inclusive, of approximately $45,000,000. Solano's mineral production in 1925 was valued at $2,678,547 and it ranked fourteenth among the counties of the state.

Its resources have been described in earlier reports and bulletins of the State Mineralogist; the quicksilver deposits particularly in Bulletin No. 78, 1918, and the petroleum possibilities in Bulletin No. 89, 1921. The last general survey was made in 1920 and embodied in Report XVII of the State Mineralogist.

The present report is an endeavor to bring these data up to date in conformity with the new series of county reports begun in 1925.

The table herewith gives the detailed record of mineral output from 1873 to 1925, inclusive. No figures are available prior to 1873, although production began in 1860.

BRICK AND CLAY.

The only clay being produced in the county is that mined by the Pacific Portland Cement Company for use in the manufacture of cement at the company's plant at Cement. This clay material is dug by steam shovel from beds adjacent to the mill.

In former years a number of clay working plants, including a pottery at Benicia and brick and tile plants at Vallejo, were active for a time.

The Steiger Brick and Tile Company was the last to operate. The property which this company undertook to exploit is situated at tidewater two miles northwest of the center of Vallejo. Improvements were made in the kilns and plant and an excellent quality of brick and tile produced for a time, but mismanagement of the company's affairs resulted in the suspension of operations in the latter part of 1923. An analysis of the yellow shale on the property is reported as follows:

Loss on ignition (moisture and carbonic acid)	8.03%
Silicia	57.83%
Alumina	19.52%
Iron oxides	7.46%
Calcium oxides	1.24%
Magnesium oxides	2.06%
Alkalies (balance)	3.86%
	100.00%

SOLANO COUNTY 1873-1925.

Year	Quicksilver		Mineral water		Lime and limestone		Miscellaneous stone[1], value	Natural gas, value	Miscellaneous and unapportioned		
	Flasks	Value	Gallons	Value	Tons	Value			Amount	Value	Substance
1873	1,800	$144,594									
1874	1,900	199,842									
1875	2,100	176,715									
1876	1,683	74,052									
1877	1,403	54,570									
1878	802	26,386									
1879	1,290	38,507									
1880	492	15,252									
1881											
1882											
1883											
1884											
1885											
1886											
1887											
1888											
1889											
1890											
1891											
1892											
1893											
1894					6,400	$8,000	$225				
1895					4,300	4,635	19,050				
1896			3,004	$1,547	5,477	5,989	15,752		75 tons	$125	Pottery clay.
1897					9,603	9,801	20,975		400 tons	500	Pottery clay
1898					6,125	5,570	15,065				
1899			20,000	4,000		356	12,181				
1900			20,000	4,000	1,800	1,800	18,900				
1901			17,800	4,450		5,950[2]	2,200				
1902	42	1,890	10,000	4,000			14,250		75,000 bbls.	150,000	Cement.
1903	100	4,100	10,000	4,000			21,514		250,000 bbls.	375,000	Cement
1904	[3]377	15,080	10,000	4,000			11,113				
1905	542	18,518	10,000	4,000	100,000	100,000	78,573				
1906	528	19,272	4,000	4,000			143,487				
1907	640	24,422	40,000	4,000			202,146	$6,584	125 tons	600	Salt.
									3,000 M.	25,000	Brick.
1908	764	33,294	140,000	11,600			527,319	8,053	400 tons	2,800	Salt.
									1,000 M.	7,000	Brick.
									100 tons	200	Salt.
1909			32,050	5,490			176,813	7,538	1,600 M.	20,000	Brick.
									5,600 tons	11,200	Clay.
1910			32,400	3,960			241,949	9,100	50 tons	150	Salt.
1911			30,000	4,000			181,952	8,596	100 tons	300	Salt.
									500 M.	4,000	Brick.
1912			285,050	44,000			130,445	8,528	50 tons	100	Salt.
									2,200 M.	20,000	Brick.
1913			23,600	3,440			28,915	7,366		13,570,619	Unapportioned, 1000-1913, inclusive.
1914	320	15,696	43,020	5,208	80,128	86,128	74,288	5,540		1,500,000	Other minerals.
1915	"	"	64,200	8,000	"	"	57,576	"		1,200,347	Cement, fuller's earth, natural gas, quicksilver, salt.
1916	660	61,710	11,200	3,750			49,711	"		1,080,164	Cement, natural gas, salt.
1917	554	52,765	10,960	2,580			39,826	"		1,804,060	Cement, fuller's earth, natural gas, salt.
1918	593	59,122	11,440	2,722			30,124	"		1,378,758	Cement, fuller's earth, natural gas, onyx, salt.
1919	"	"	"	"	"	"	44,156	"		1,627,028	Cement, fuller's earth, mineral water, natural gas, quicksilver.
1920	"	"	"	"	"	"	"	"		2,930,614	Cement, limestone, onyx, mineral water, natural gas, quicksilver miscellaneous stone.
1921			"				60,604			2,960,594	Cement, mineral water, onyx.
1922			"				103,394			3,004,720	Cement, mineral water, onyx
1923	"		"				113,545			3,263,340	Cement, mineral water, onyx, quicksilver.
1924			"				117,475			2,972,000	Cement, mineral water, onyx.
1925			"				145,484			2,678,547	Cement, mineral water, onyx.
Totals	[3]10,650	$1,035,787	[3]820,324	$132,747	[3]210,838	$228,229	[3]$2,677,097	[3]$61,311		$40,697,966	

[1]Includes crushed rock, rubble, paving blocks, sand, gravel.
[2]Flasks of 75 pounds since June, 1908, 76½ pounds previously.
[3]See under "Unapportioned."

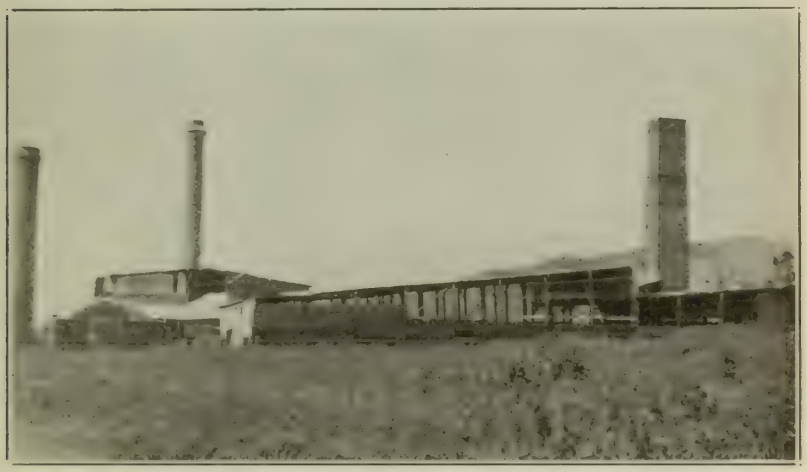
Clay from a bank at the base of the hills near Goodyear station was utilized about 20 years ago in a Benicia pottery, since abandoned.

Although there does not appear to be deposits of high-grade clay of special commercial value in the county, there is apparently an abundant supply of the more common clays adaptable to the manufacture of brick and tile.

Bibl: State Mineralogist's Report VIII, p. 631; XIII, p. 619; XIV, p. 300; XVII, p. 242. State Mining Bureau Bull. 38, p. 258. Prel. Rep. No. 7.

CEMENT.

Portland cement has been the leading mineral product of Solano County for the last 25 years. The Pacific Portland Cement Company, which was organized in May, 1901, completed their first mill of 1600



Steiger Brick and Tile Company's Plant, Solano County. Idle.

barrels daily capacity at Cement in this county in 1902. The original plant has been rebuilt and expanded at intervals, the present mill having a capacity of 4200 barrels per day.

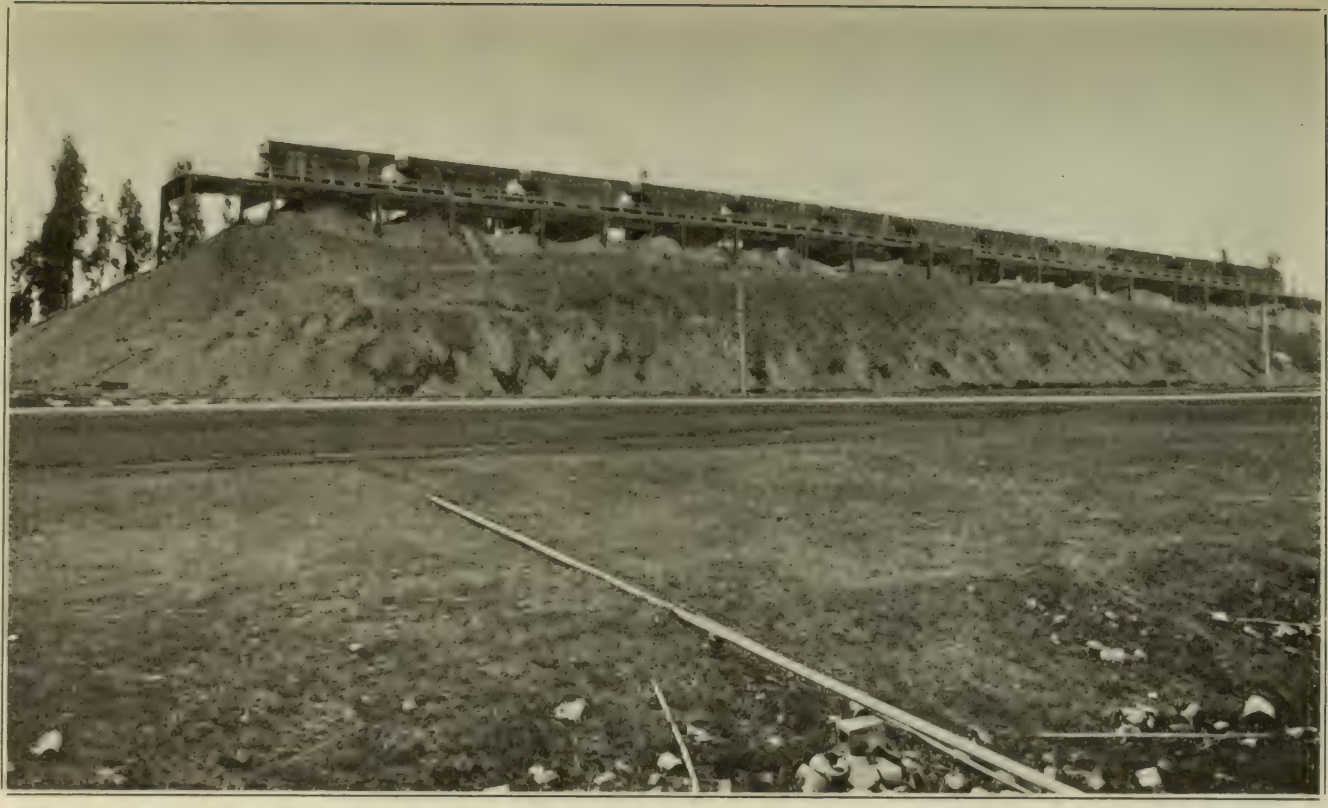
Pacific Portland Cement Company. Head office, Pacific Building, San Francisco. Robt. B. Henderson, president; J. H. Colton, vice president, in charge of operations.

This company now has three cement plants and two plaster mills, together with extensive deposits of limestone, gypsum, clay and other raw materials required in the manufacture of its products which are known by the trade names of Golden Gate and Old Mission brands of cement and Empire brand plaster. The cement plants are located at Cement, Solano County; Redwood City, San Mateo County, and San Juan, San Benito County (formerly Old Mission Portland Cement Co.). The gypsum mills are at Plaster City, Imperial County, Cal., and Gerlach, Nevada.

The Solano County cement mill is situated in the town of Cement, which is connected with the main line of the Southern Pacific railroad



Pacific Portland Cement Company's Mill, at Cement, Solano County.—Photo by courtesy of the company



Raw Limestone Storage Pile at Pacific Portland Cement Company's Plant, Cement, Solano County.—Photo by courtesy of the company.

by the company's Cement, Tolenas and Tidewater railroad, a standard gauge line.

The dry process of manufacture is used at this plant. Some low-grade limestone remains in the deposit at the plant site, but all the limerock now being used is shipped in from the company's mountain quarries on the Middle Fork of the American River in El Dorado County, seven miles from Auburn. The output of these quarries has amounted to more than 1000 tons per day for the past 10 years. The clay used is dug locally and the gypsum required as a retarder is shipped in from the company's plant at Gerlach. Eleven short kilns are used, varying in length from 80 to 100 feet. The mill is operated by electric power, about 3500 horse power, supplied by the Pacific Gas and Electric Company, being required. The capacity of the plant is 4200 barrels per day and 90,000 barrels storage capacity is provided. Three hundred men are employed. The town of Cement closely approaches an ideal industrial center and little labor turnover results. M. J. Johnson is plant superintendent.

Bibl: State Mineralogist's Report X, p. 670; XII, p. 395; XIII, p. 632; XIV, pp. 302–307; XVII, p. 243; State Mining Bureau Bull. 38, pp. 185–189. Geol. Sur. of Cal., Geol., Vol. I, p. 104. U. S. Geol. Sur. Bull. 243, p. 120; Bull. 522, pp. 118, 121.

CHROMITE.

Chromite is reported to occur near Fairfield. A specimen in the Bureau Museum is said to have come from that locality, but the extent of the deposit is unknown.

Bibl: State Mineralogist's Report IV, p. 137; VI, p. 101; VIII, p. 632; XIV, p. 307. State Mining Bureau Bull. 38, p. 363.

COAL.

An occurrence of lignite coal has been noted in the southwestern part of the county in the hills adjacent to Goodyear station. The vein which has only been exposed for a short distance is six inches in thickness.

Bibl: State Mineralogist's Report VI, p. 118; VII, p. 151; XIV, p. 307. Geol. Sur. of Cal., Geol. Vol. I, p. 106.

FULLER'S EARTH.

This term includes many kinds of unctuous earths. They are used in the clarifying, filtering and decolorizing of mineral, animal and vegetable oils, de-inking of newspapers and many other special uses.

Old Rocky Ranch Deposit. This property comprises 166 acres lying immediately north of the holdings of the Standard Oil Company. Fuller's earth, undoubtedly a continuation of the beds exposed farther south, occurs on the ranch. The deposit has not been developed. Estate of Dr. L. C. Marshall, owner, Vacaville, Cal.

Bibl: State Mineralogist's Report XIV, pp. 307–309; XVII, p. 243. State Mining Bureau Bull. 38, p. 273. U. S. Geol. Sur. Bull. 315, pp. 268–290; Bull. 365; 475. Min. Res. 1907, 1911, 1912. U. S. B. of M. Bull. 71.

Standard Oil Company's Deposit. A deposit of white to light gray colored Monterey shale which outcrops about one-half mile northwest of the railroad station at Vacaville has been utilized in the past as fuller's earth. The deposit was originally opened up by the Western Fuller's Earth Company. Later, 34 acres covering the principal exposures were purchased by the Standard Oil Company of California. A small house was erected, a well put down and several carloads of the material were mined and shipped during 1918 and 1919. Since then there has been no activity.

MINERAL WATER.

Blue Rock Springs. (Vallejo White Sulphur Spring.) Owner, Manuel Madrid, Vallejo. These sulphur springs are in Sec. 10, T. 3 N., R. 3 W., five miles northeast of Vallejo. The main spring is stated to have a flow of about 100,000 gallons per twenty-four hours. The water is bottled and sold under the name Blue Rock Water. There is a swimming pool, hotel and camping accommodations.

Bibl: State Mineralogist's Report XII, p. 347; XIII, p. 520; XIV, p. 310; XVII, p. 246. U. S. Geol. Sur. Bull. 32, p. 209; Water Supply Pap. 338, p. 255. W. Anderson (op. cit.), p. 260.

Tolenas Springs. These carbonated springs are situated six miles north of Fairfield. The onyx marble found here is undoubtedly a result of deposition from the carbonated springs near which the water still issues. This water has not been commercially used for many years, although it was at one time bottled for sale. There are no accommodations for guests.

Bibl: State Mineralogist's Report VI, p. 74; X, pp. 668, 670; XII, p. 346; XIII, p. 521; XIV, p. 309. State Mining Bureau Bull. 24, p. 138. U. S. Geol. Sur. Bull. 32, p. 209; Water Supply Pap. 338, pp. 162–163. Mineral Springs and Health Resorts of Cal., W. Anderson, p. 255.

NATURAL GAS.

Well-defined gas blows have been noted in Secs. 11 and 14, T. 5 N., R. 1 W., and numerous seepages of gas occur along the edge of the marsh bordering Suisun Bay from Benicia northeastward for seven miles. Small amounts of this gas are used locally for cooking by the duck clubs and ranchers. Commercial production of natural gas was made for a number of years from a well drilled in 1901 by the Rochester Oil Company in the NE¼ Sec. 24, T. 5 N., R. 1 W. This well reached a depth of 1820 feet. Gas was encountered at 1520 feet and the well produced at the rate of 20,000 cubic feet per day for several years. The gas was delivered to Suisun, Fairfield and Cement through pipe lines under its own pressure, but by 1920 the gas flow had nearly ceased as the well had been neglected and there has been no commercial output since then.

Bibl: State Mineralogist's Report VIII, p. 185; X, pp. 659–660; XIII, p. 569; XIV, p. 310; XVII, p. 246. State Mining Bureau Bull. 3, p. 5; Bull. 89, pp. 52–55.

ONYX MARBLE.

Deposits of travertine and aragonite, also referred to as onyx marble or 'Suisun' marble, occur in the vicinity of Tolenas Springs, six miles north of Fairfield. Some of the material shows a beautiful banded and wavy structure. Similar 'marble' comprises the principal limestone deposit at Cement owned by the Pacific Portland Cement Company, originally utilized in the manufacture of cement. The travertine at Tolenas Spring deposit has been quarried from time to time and used in the making of terrazzo and for other ornamental purposes. The deposit was last leased to S. Miletin, 121 Fourteenth Street, San Francisco. No material has been taken out since the latter part of 1926. A tractor used in hauling from the spring to the highway has been removed and the road to the deposit is now in poor shape.

Bibl: State Mineralogist's Report I, p. 17; IV, p. 73; V, p. 67; VI, pp. 22, 91; VIII, p. 631; X, pp. 668-670; XII, p. 403; XIII, pp. 632, 641; XIV, p. 311. State Mining Bureau Bull. 37, p. 112; Bull. 38, p. 114. Geol. Sur. of Cal., Geol. Vol. I, p. 104. U. S. Geol. Survey Water Sup. Pap. 338, p. 162.

PETROLEUM.

Two small areas in Solano County have been classified by Vander Leck[1] as 'possible' oil bearing areas; 'possible' being defined as land on which there is the slightest indication of petroleum but which remains unproven to date (1921). The indications and localities are described as follows: (a) "About one mile southeast of Cannon in Secs. 11 and 14, T. 5 N., R. 1 W., there are several well-defined 'gas blows.' These gas blows occur along the axis of a fold in the Chico sandstone, and in the vicinity of the 'blow' the rocks have been burnt to a brick-red slag. (b) In the Potrero Hills, east of Fairfield, there are numerous seepages of gas reported in the Meganos shales." The structural conditions in these two areas are regarded by Vander Leck as favorable for the accumulation of petroleum.

He further states "the unfavorable factor is the character of the formation present (contaceous) which is distinctly unfavorable for the formation of petroleum in an appreciable amount. * * * Summing these factors up, it would appear that wells drilled along the axis of the anticlines and faults * * * should obtain showing of oil and, possibly, under the most favorable conditions, obtain small quantities of oil. Whether these small quantities of oil that might be obtained would be of commercial value can only be determined by drilling. Due to the favorable structure and the large area of possible accumulation, the anticline southeast of Vacaville and the dome in the Potrero Hills may be considered as the most favorable locality to test out the district."

Subsequent to the publication of Bulletin No. 89 the two areas mentioned were drilled by the Honolulu Consolidated Oil Company without obtaining commercial production. These wells were in the

[1] Vander Leck, Lawrence, Petroleum Resources of California, with special reference to unproved areas. State Mining Bureau Bulletin 89, 1921.

SW¼ Sec. 13, T. 5 N., R 1 W., and in NE¼ Sec. 9, T. 4 N., R. 1 W., respectively.

Bibl: State Mineralogist's Report XIII, p. 185; X, pp. 659, 660; XIII, p. 569; XIV, p. 311; XVII, p. 246. State Mining Bureau Bull. No. 3, p. 5; Bull. 89, pp. 49–57.

QUICKSILVER.

The known quicksilver deposits in Solano County are all located within a few miles of one another on Sulphur Springs mountain ridge in Tps. 3 and 4 N., R. 3 W. Three properties have been more or less exploited, of which St. John's mine has been the chief producer.

These deposits have been described in detail by Bradley[1] in Bulletin No. 78, which is still available. Additional data is contained in the publications listed in the bibliography herewith. To include herein detailed descriptions of the geology and workings would be a useless repetition and this report is therefore confined to notes on such changes in status as have occurred subsequent to the publication of Bulletin No. 78.

Brownlie Mine. There has been no activity at this property.

Hasting's Mine. The Hasting's Mine is in Sec. 14, T. 3 N., R. 3 W., seven miles by road north of Benicia and 4½ miles in an air line north of east from Vallejo.

This property was taken under lease by Arthur G. Beck and a small group of associates, operating under the name *Hastings Quicksilver Mining Company,* in January, 1927. They immediately began cleaning out the main adit, and are now in 600 feet. Work is being continued by a small force. If sufficient ore is developed the reduction equipment at the mine will be put in working shape or new equipment placed on it. When last operated the ore being treated was yielding 1.72% mercury.

St. John's Mine. The last output of quicksilver from the St. John's Mine was made in 1923, since which time it has been idle. Most of the surface equipment has lately been destroyed by fire, and the workings are flooded.

Bibl: State Mineralogist's Report I, p. 26; VIII, p. 631; X, p. 661; XIII, p. 599; XIV, pp. 311–312; XVII, p. 246. State Mining Bureau Bull. 20, p. 19; Bull. 27, pp. 93–97; Bull. 78, pp. 171–180. U. S. Geol. Sur. Mon. XIII, p. 378; An. Rep. XXI, Pt. VI, p. 278; Min. Res. 1907–1912; Min. Res. W. of Rocky Mts. 1873, p. 10; 1874, pp. 30, 31; 1875, pp. 14, 178; 1876, p. 20. Min. & Sci. Press, Vol. 109, p. 585.

SALT.

Salt water accompanied the flow of natural gas from the well of the Rochester Oil Company in Sec. 24, T. 5 N., R. 1 W. This water was run into a shallow basin about 10 acres in extent. The salt obtained by natural evaporation of the water during the summer

[1] Bradley, Walter W., Quicksilver Resources of California, State Mining Bureau Bulletin 78, 1918.

months was harvested for several years and sold at the well, principally for salting live stock. There has been no production for about 10 years.

Bibl: State Mineralogist's Report XIV, p. 312.

STONE INDUSTRY.

For many years Solano County was an important producer of miscellaneous stone, but at the present time there are no rock quarries in operation.

The chief production has come from the quarry located on an isolated hill of basalt at the edge of the marsh land one mile east of Cordelia. This quarry has been variously known as Cordelia, Thomasson, McNaughton's and E. B. and A. L. Stone Company's Quarry. It was first opened up about 1875 and for 20 years produced principally paving blocks, for which the rock was well suited. When the demand



E. B. and A. L. Stone Company's Quarry, near Cordelia, Solano County. Idle.

for paving blocks declined the quarry was equipped with a rock crushing plant of 1000 tons daily capacity.

E. B. and A. L. Stone Company. After this company acquired the quarry the capacity of the bunkers was increased. A washing plant, pumping water from Cordelia slough, added and other improvements made. Operations continued until December, 1925, when the company became involved in financial difficulties and the plant was closed down under attachment proceedings. J. M. Nelson, superintendent, and a caretaker are in charge. Idle.

Bibl: State Mineralogist's Report X, p. 659; XII, p. 390; XIII, pp. 627, 634. State Mining Bureau Bull. 38, pp. 325, 342.

Vulcan Rock Company. This quarry is situated at Hoyt siding about one mile north of Goodyear Station and northeast of Benicia. All equipment has been removed and the property has been idle for about 15 years. It is reported that this quarry has been purchased

within the last six months and that the new owners may again open it up.

Bibl: State Mineralogist's Report X, p. 669; XII, p. 390; XIII, p. 627. State Mining Bureau Bull. 38, p. 325.

A number of other smaller quarries once active in the county are all abandoned.

LOS ANGELES FIELD DIVISION

W. Burling Tucker, Mining Engineer.

On account of unfinished field work there is no report from the Los Angeles Field Division in this issue.

OIL FIELD DEVELOPMENT OPERATIONS.

By R. D. Bush, State Oil and Gas Supervisor.

From January 1, 1927, to and including April 2, 1927, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
ALAMEDA COUNTY:					
Howell and DeNormandie		2	2	1	
COLUSA COUNTY:					
Brown and Hilm	31	15	4	1	
FRESNO COUNTY:					
Pilot Oil Co.	12	20	14	9	Coalinga
Standard Oil Co.	35	19	15	39	Coalinga
E. H. Mitchell	22	21	15	Marland-Mitchell 1	
KERN COUNTY:					
Carneros Oil Co	30	28	21	36	Belridge
Carneros Oil Co	30	28	21	46	Belridge
Carneros Oil Co	30	28	21	47	Belridge
Carneros Oil Co.	31	28	21	68	Belridge
Union Oil Co.	24	28	20	Colm 1	Belridge
Midway Northern Oil Co	25	25	18	1	Devils Den
R. H. Sayers	25	25	18	1	Devils Den
McAdams Petroleum Corp.	2	30	22	1	Elk Hills
Union Oil Co	26	30	24	Elk Hills 19	Elk Hills
Barnsdall Oil Co.	30	27	28	Fortine 1	Kern River
C. C. M. O. Co	23	28	27	2	Kern River
C. C. M. O. Co	23	28	27	3	Kern River
General Petroleum Corp	14	28	27	18	Kern River
General Petroleum Corp	14	28	27	21	Kern River
General Petroleum Corp.	14	28	27	26	Kern River
George F. Getty	14	28	27	Lehnhardt 1	Kern River
George F. Getty	14	28	27	Lehnhardt 2	Kern River
George F. Getty	14	28	27	Lehnhardt 8	Kern River
George F. Getty	14	28	27	Lehnhardt 13-A	Kern River
George F. Getty, Inc	22	28	27	Tegeler 11	Kern River
George F. Getty, Inc	22	28	27	Tegeler 12	Kern River
George F. Getty, Inc	22	28	27	Tegeler 13	Kern River
George F. Getty, Inc.	22	28	27	Tegeler 20	Kern River
George F. Getty, Inc	22	28	27	Tegeler 21	Kern River
Petroleum Securities Co	22	28	27	4	Kern River
Wonder Co., Ltd	23	28	27	1	Kern River
Richfield Oil Co	13	26	20	2-A	Lost Hills
Universal Consolidated Oil Co.	32	26	21	48	Lost Hills
H. H. Bell	4	30	22	2	McKittrick
McKittrick Hills Oil Co	18	30	22	2	McKittrick
Bolsa Chica Oil Co	1	31	22	1	Midway
C. C. M. O. Co	21	31	22	2	Midway
C. C. M. O. Co	27	31	22	4	Midway
General Petroleum Corp	32	31	24	Buena Vista 12	Midway
Frank D. Gore Corp.	34	30	22	12	Midway
Honolulu Consolidated Oil Co	8	32	24	5	Midway
Honolulu Consolidated Oil Co	8	32	24	6	Midway
Honolulu Consolidated Oil Co	8	32	24	7	Midway
Honolulu Consolidated Oil Co	8	32	24	9	Midway
Honolulu Consolidated Oil Co	8	32	24	15	Midway
Honolulu Consolidated Oil Co.	8	32	24	17	Midway
Honolulu Consolidated Oil Co.	8	32	24	19	Midway
Honolulu Consolidated Oil Co	8	32	24	76	Midway
Honolulu Consolidated Oil Co.	8	32	24	86	Midway
Honolulu Consolidated Oil Co.	8	32	24	87	Midway
Honolulu Consolidated Oil Co	8	32	24	88	Midway
Interstate Oil Corp	15	32	23	Perris 6-A	Midway
A. T. Jergins Trust	15	31	22	14	Midway
Midland Oilfields Co., Ltd	34	31	24	Thornber B-5	Midway
Midway Peerless Oil Co.	15	31	22	4-X	Midway

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued.					
North American Oil Consolidated	32	31	24	9	Midway
North American Oil Consolidated	30	31	24	43	Midway
Standard Oil Co.	9	32	24	7	Midway
Standard Oil Co.	9	32	24	8	Midway
Standard Oil Co.	9	32	24	10	Midway
Standard Oil Co.	7	32	24	21	Midway
Standard Oil Co.	7	32	24	24	Midway
Standard Oil Co.	7	32	24	25	Midway
Standard Oil Co.	7	32	24	26	Midway
Standard Oil Co.	31	31	24	27	Midway
Standard Oil Co.	17	32	24	40	Midway
Standard Oil Co.	29	31	24	45	Midway
Standard Oil Co.	29	31	24	46	Midway
Standard Oil Co.	9	32	24	46	Midway
Standard Oil Co.	31	31	24	64	Midway
The United Oil Co.	6	31	23	Mason 4	Midway
Barnsdall Oil Co.	8	27	28	2	Mt. Poso
Midland Oilfields Co., Ltd.	4	27	28	Alta Vedder 1	Mt. Poso
Shell Co.	1	27	27	Glide 1	Mt. Poso
Shell Co.	9	27	28	Vedder 4	Mt. Poso
Shell Co.	9	27	28	Vedder-Rall 1	Mt. Poso
Union Oil Co.	5	27	28	S. & M. 3	Mt. Poso
Bankline Oil Co.	6	11	23	11	Sunset
General Petroleum Corp.	32	12	23	Midnorth 17	Sunset
Standard Oil Co.	10	11	23	Rass 4	Sunset
Union Oil Co.	10	11	23	Boss 3	Sunset
Union Oil Co.	10	11	23	Houchin 2	Sunset
Union Oil Co.	10	11	23	Whittier-Kent 1	Sunset
Max L. Pray	1	29	20	1	Temblor
Standard Oil Co.	27	11	20	Kern County Lease No. 2 28	Wheeler Ridge
Standard Oil Co.	27	11	20	Kern County Lease No. 2 29	Wheeler Ridge
C. C. M. O. Co.	23	25	27	1	
C. C. M. O. Co.	28	31	22	2	
Elbe Oil Land Development Co.	20	28	29	1	
Hoyt S. Gale	6	30	28	K. C. L. 1	
John B. Harding	5	10	10	1	
Huntington-Hawthorne Oil and Gas Co.	35	26	18	Barry 3	
Milham Exploration Co.	7	29	24	Salisbury 1	
Howard S. Mountford	18	27	19	1	
Muroc Development Co.	13	29	26	Rosedale 2	
Zurich Oil Co.	18	28	22	1	
KINGS COUNTY:					
C. C. M. O. Co.	17	24	19	1	
Milham Exploration Co.	2	22	17	Elliot 1	
LOS ANGELES COUNTY:					
Shell Co.	33	3	13	Reyes 37	Dominguez
Shell Co.	34	3	13	Reyes 38	Dominguez
Union Oil Co.	28	3	13	Callender 17	Dominguez
Union Oil Co.	33	3	13	Callender 18	Dominguez
Union Oil Co.	33	3	13	Callender 19	Dominguez
Union Oil Co.	33	3	13	Hellman 15	Dominguez
California Eastern Oil Co.	27	2	14	Cypress Heights 1	Inglewood
Standard Oil Co.	17	2	14	Baldwin-Cienega 42	Inglewood
Standard Oil Co.	17	2	14	Baldwin-Cienega 52	Inglewood
Standard Oil Co.	17	2	14	L.A. Invest. 1 52	Inglewood
Standard Oil Co.	16	2	14	Stocker 10	Inglewood
Standard Oil Co.	7	2	14	Vickers 1 21	Inglewood
California Eastern Oil Co.	30	4	12	Brayton 1	Long Beach
California Eastern Oil Co.	29	4	12	Manser 1	Long Beach
California Petroleum Corp.	19	4	12	Foster Two 3	Long Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
Delaney Petroleum Corp	29	4	12	2	Long Beach
Delaney Petroleum Corp	29	4	12	5	Long Beach
Edward B. Giffen	19	4	12	1	Long Beach
Julian Petroleum Corp	28	4	12	Peacock 1-A	Long Beach
Miley Oil Co	19	4	12	Mills 6	Long Beach
Painted Hills Oil Assn	19	4	12	13	Long Beach
Shell Co.	19	4	12	Cresson Comm. 7	Long Beach
Signal Syndicate	19	4	12	3	Long Beach
Signal Syndicate No. 2	19	4	12	2	Long Beach
Union Oil Co.	30	4	12	Long Beach Comm. 15	Long Beach
The United Oil Co.	19	4	12	Haas 12	Long Beach
McGinley Oil Co	6	2	11	27	Montebello
St. Helens-Riverside Properties	2	2	12	Monterey 14	Montebello
St. Helens-Riverside Properties	2	2	12	Monterey 15	Montebello
Standard Oil Co.	2	2	12	Baldwin 70	Montebello
Union Oil Co.	2	2	12	LaMerced 29	Montebello
Big Five Oil Co.	18	3	13	4	Rosecrans
California Petroleum Corp	35	2	14	Armour Morse One 1	Rosecrans
California Petroleum Corp	34	2	14	Sutton 1	Rosecrans
California Petroleum Corp	35	2	14	Toms 1	Rosecrans
Fred E. Cole	7	3	13	1	Rosecrans
General Petroleum Corp	35	2	14	Smith 1	Rosecrans
General Petroleum Corp	18	3	13	Vaughn 6	Rosecrans
Union Oil Co.	18	3	13	Howard Park 34	Rosecrans
Union Oil Co.	18	3	13	Rosecrans 9	Rosecrans
Fred A. Walker	35	2	14	Potrero-Cypress 1	Rosecrans
Alamitos Oil Co	3	5	12	1	Seal Beach
Associated Oil Co	11	5	12	Bryant 2	Seal Beach
Associated Oil Co	11	5	12	Bryant 3	Seal Beach
Associated Oil Co.	11	5	12	Bryant 4	Seal Beach
Associated Oil Co	11	5	12	Bryant 5	Seal Beach
Associated Oil Co	11	5	12	Bryant 6	Seal Beach
Associated Oil Co	11	5	12	Bryant 7	Seal Beach
Associated Oil Co	11	5	12	Bryant 21	Seal Beach
Associated Oil Co	11	5	12	Bryant 31	Seal Beach
Associated Oil Co	11	5	12	Hellman 2	Seal Beach
Associated Oil Co	11	5	12	Hellman 3	Seal Beach
Associated Oil Co.	11	5	12	Hellman 10	Seal Beach
Bankline Oil Co.	3	5	12	1	Seal Beach
California Eastern Oil Co	3	5	12	Fueller 1	Seal Beach
California Eastern Oil Co	3	5	12	Graves 1	Seal Beach
California Eastern Oil Co	3	5	12	Horwitz 1	Seal Beach
California Eastern Oil Co	3	5	12	Ostaff 1	Seal Beach
California Eastern Oil Co	3	5	12	Person 1	Seal Beach
California Petroleum Corp	3	5	12	Alamitos 1	Seal Beach
California Petroleum Corp	3	5	12	Alamitos 2	Seal Beach
California Petroleum Corp	3	5	12	Alamitos 3	Seal Beach
California Petroleum Corp	3	5	12	Alamitos 4	Seal Beach
California Petroleum Corp	3	5	12	Alamitos 5	Seal Beach
California Petroleum Corp	3	5	12	Bailey 1	Seal Beach
California Petroleum Corp	3	5	12	Benton 1	Seal Beach
California Petroleum Corp	3	5	12	Hodges 1	Seal Beach
California Petroleum Corp	3	5	12	Lovell 1	Seal Beach
California Petroleum Corp	3	5	12	McMasters 1	Seal Beach
California Petroleum Corp	3	5	12	Smith 1	Seal Beach
Crabarn Oil Corp	3	5	12	1	Seal Beach
Dominguez Extension Oil Co	3	5	12	2	Seal Beach
General Petroleum Corp	4	5	12	Wasem 1	Seal Beach
General Petroleum Corp	3	5	12	Wasem 2	Seal Beach
General Petroleum Corp	3	5	12	Wasem 3	Seal Beach
General Petroleum Corp	3	5	12	Wasem 4	Seal Beach
General Petroleum Corp	3	5	12	Wasem 5	Seal Beach
General Petroleum Corp	3	5	12	Wasem 6	Seal Beach
General Petroleum Corp	3	5	12	Wasem 7	Seal Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
General Petroleum Corp.	4	5	12	Wasem 8	Seal Beach
General Petroleum Corp.	3	5	12	Wasem 9	Seal Beach
George F. Getty, Inc.	3	5	12	S. B. 1	Seal Beach
George F. Getty, Inc.	3	5	12	S. B. 2	Seal Beach
George F. Getty, Inc.	3	5	12	S. B. 3	Seal Beach
George F. Getty, Inc.	3	5	12	S. B. 4	Seal Beach
George F. Getty, Inc.	3	5	12	S. B. 5	Seal Beach
George F. Getty, Inc.	3	5	12	S. B. 6	Seal Beach
George F. Getty, Inc.	3	5	12	S. B. 7	Seal Beach
George F. Getty, Inc.	3	5	12	S. B. 8	Seal Beach
George F. Getty, Inc.	3	5	12	S. B. 9	Seal Beach
J. Paul Getty	3	5	12	Alamitos Fee 1	Seal Beach
J. Paul Getty	3	5	12	Alamitos Fee 2	Seal Beach
J. Paul Getty	3	5	12	Alamitos Fee 3	Seal Beach
J. Paul Getty	3	5	12	Cleaver 1	Seal Beach
J. Paul Getty	3	5	12	Cleaver 2	Seal Beach
J. Paul Getty	3	5	12	Cleaver 3	Seal Beach
J. Paul Getty	3	5	12	Cleaver 4	Seal Beach
J. Paul Getty	3	5	12	Cleaver 5	Seal Beach
J. Paul Getty	3	5	12	Heimer 1	Seal Beach
Greene and Magee	3	5	12	1	Seal Beach
A. S. Johnston Drilling Co.	3	5	12	1	Seal Beach
Marland Oil Co.	11	5	12	Bixby 9	Seal Beach
Marland Oil Co.	11	5	12	Bixby 10	Seal Beach
Marland Oil Co.	11	5	12	Bixby 11	Seal Beach
Marland Oil Co.	3	5	12	Bixby 12	Seal Beach
Marland Oil Co.	2	5	12	Bixby 13	Seal Beach
Marland Oil Co.	11	5	12	Bixby 15	Seal Beach
Marland Oil Co.	11	5	12	Bixby 16	Seal Beach
Marland Oil Co.	11	5	12	Bixby 17	Seal Beach
Marland Oil Co.	11	5	12	Bixby 18	Seal Beach
Marland Oil Co.	11	5	12	Bixby 19	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 4	Seal Beach
Marland Oil Co.	10	5	12	McGrath and Selover 5	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 9	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 10	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 11	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 12	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 13	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 14	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 15	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 16	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 17	Seal Beach
Marland Oil Co.	3	5	12	McGrath and Selover 19	Seal Beach
Miley Oil Co.	3	5	12	Alamitos 1	Seal Beach
Miley Oil Co.	3	5	12	Alamitos 2	Seal Beach
N. W. Pannill	3	5	12	1	Seal Beach
Petroleum Securities Co.	3	5	12	Naples 2	Seal Beach
Petroleum Securities Co.	3	5	12	Naples 3	Seal Beach
Petroleum Securities Co.	3	5	12	Naples 4	Seal Beach
Petroleum Securities Co.	3	5	12	Naples 5	Seal Beach
Rainbow Petroleum Co.	3	5	12	Gibson 1	Seal Beach
Richfield Oil Co.	3	5	12	Bonner 1	Seal Beach
Richfield Oil Co.	3	5	12	Doyle 1	Seal Beach
Richfield Oil Co.	3	5	12	Reinhold 1	Seal Beach
J. T. Robertson Co.	3	5	12	6	Seal Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
Standard Oil Co	3	5	12	San Gabriel 9	Seal Beach
Standard Oil Co	3	5	12	San Gabriel 10	Seal Beach
Standard Oil Co	11	5	12	San Gabriel 11	Seal Beach
Standard Oil Co	11	5	12	San Gabriel 12	Seal Beach
Superior Oil Co	3	5	12	Fee 1	Seal Beach
Superior Oil Co	3	5	12	Fee 1 2	Seal Beach
Superior Oil Co	3	5	12	Green 1	Seal Beach
Superior Oil Co	3	5	12	Horwitz 1	Seal Beach
Superior Oil Co	3	5	12	Kenkel 1	Seal Beach
Universal Consolidated Oil Co	3	5	12	Enloe 1	Seal Beach
Universal Consolidated Oil Co	3	5	12	Judson 1	Seal Beach
Universal Consolidated Oil Co	3	5	12	Patterson 1	Seal Beach
Universal Consolidated Oil Co	3	5	12	Wolfe 1	Seal Beach
Fred A. Walker	4	5	12	Jones 1	Seal Beach
Fred A. Walker	4	5	12	Parker 1	Seal Beach
White-Hart Oil Syn	3	5	12	White-Hart 1	Seal Beach
C. C. M. O. Co	17	4	14	Del Amo 70	Torrance
C. C. M. O. Co	8	4	14	Del Amo 97	Torrance
Petroleum Securities Co	27	4	14	Weston 1	Torrance
Spadra Oil Co	34	1	9	7	
ORANGE COUNTY:					
Birch Oil Co	2	3	10	13-A	Brea Olinda
Fullerton Oil Co	2	3	10	22	Brea Olinda
General Petroleum Corp	6	3	9	Tonner 8-A	Brea Olinda
Shell Co. of California	2	3	10	Orange 15	Brea Olinda
Union Oil Co	1	3	10	Stearns 69	Brea Olinda
Union Oil Co	1	3	10	Stearns 70	Brea Olinda
Chiksan Oil Co	19	3	9	Herndon 1	Coyote Hills
Ahlburg Oil Corp	10	6	11	Bundy 10	Huntington Beach
Ahlburg Oil Corp	3	6	11	Horton 7	Huntington Beach
Ahlburg Oil Corp	10	6	11	Keck 8	Huntington Beach
Ahlburg Oil Corp	10	6	11	Lee 9	Huntington Beach
Ahlburg Oil Corp	10	6	11	Mills 6	Huntington Beach
H. F. Alexander Oil Well	10	6	11	1	Huntington Beach
Auburn Oil Co	35	5	11	1-A	Huntington Beach
Barneson & Macklin	10	6	11	Laughlin 1	Huntington Beach
Barry Oil Assn	10	6	11	5	Huntington Beach
Bruce Oil Co	34	5	11	9	Huntington Beach
Byrens Oil Corp	10	6	11	1	Huntington Beach
California Petroleum Corp	28	5	11	Buck 3	Huntington Beach
Walker Coan, Trustee	10	6	11	Topeka 2	Huntington Beach
Coastal Oil Co	10	6	11	2	Huntington Beach
Frank H. Cole	10	6	11	3	Huntington Beach
Concord Oil Assn	10	6	11	1	Huntington Beach
Crudoil Co	10	6	11	2	Huntington Beach
Crudoil Co	10	6	11	3	Huntington Beach
Crudoil Co	10	6	11	4	Huntington Beach
Crudoil Co	10	6	11	5	Huntington Beach
Crudoil Co	10	6	11	6	Huntington Beach
Crudoil Co	10	6	11	8	Huntington Beach
Crudoil Co	10	6	11	10	Huntington Beach
J. Paul Getty	10	6	11	Hunt. Bch. 5	Huntington Beach
Globe Lease & Royalty Co	27	5	11	2	Huntington Beach
J. E. Hall	10	6	11	1	Huntington Beach
Higgins & Dutton	10	6	11	Bundy 1	Huntington Beach
Walter W. Hoye	10	6	11	1	Huntington Beach
Huntington Signal Oil Co	10	6	11	7	Huntington Beach
Newton P. Jackson	10	6	11	1	Huntington Beach
Julian Petroleum Corp	10	6	11	Treat 2	Huntington Beach
Kohlbush and Johnston, Inc	10	6	11	Pollard-Callahan 1	Huntington Beach
Kohlbush and Johnston, Inc	10	6	11	Pollard-Callahan 2	Huntington Beach
Lewis, Sam N	10	6	11	Lewis 1	Huntington Beach
Lewis, Sam N	10	6	11	Lewis 2	Huntington Beach
Harry E. MacAdam	10	6	11	Lester 1	Huntington Beach
J. B. McMahon, Trustee	10	6	11	1	Huntington Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
ORANGE COUNTY—Continued.					
Neal D. McPhail	34	5	11	1	Huntington Beach
M. M. McVey	10	6	11	10	Huntington Beach
Miller & Thompson	10	6	11	1	Huntington Beach
Leroy Moore	10	6	11	1	Huntington Beach
J. E. O'Donnell	10	6	11	H. B. 1	Huntington Beach
Olympic Refining Co	10	6	11	H. B. 10	Huntington Beach
Olympic Refining Co	10	6	11	H. B. 11	Huntington Beach
Painted Hills Oil Assn	10	6	11	12	Huntington Beach
Prudential Oil Corp	10	6	11	2	Huntington Beach
Ring Petroleum Corp	10	6	11	7	Huntington Beach
Fred W. Roberts	10	6	11	H. B. 3	Huntington Beach
Fred W. Roberts	10	6	11	H. B. 4	Huntington Beach
Rogers and Fietz	10	6	11	1	Huntington Beach
Rogers and Fietz	10	6	11	2	Huntington Beach
Ruether & Graham	10	6	11	1	Huntington Beach
San Martinez Oil Co	10	6	11	T. W. 1	Huntington Beach
Standard Oil Co	34	5	11	Bolsa 29	Huntington Beach
Standard Oil Co	34	5	11	Bolsa 30	Huntington Beach
Standard Oil Co	10	6	11	Huntington B 57	Huntington Beach
Standard Oil Co	10	6	11	Huntington B 58	Huntington Beach
Standard Oil Co	10	6	11	Huntington B 59	Huntington Beach
Standard Oil Co	10	6	11	Huntington H 25	Huntington Beach
Standard Oil Co	10	6	11	P. E. 5	Huntington Beach
Standard Oil Co	10	6	11	P. E. 6	Huntington Beach
Standard Oil Co	10	6	11	P. E. 7	Huntington Beach
Superior Oil Co	10	6	11	Eberle 1	Huntington Beach
Superior Oil Co	10	6	11	Fee 5	Huntington Beach
Superior Oil Co	10	6	11	Nixon 2	Huntington Beach
Superior Oil Co	10	6	11	Walker 1	Huntington Beach
Trident Oil Co	10	6	11	1	Huntington Beach
Western Drilling and Producing Co	10	6	11	1	Huntington Beach
White-Smithson Oil Co	10	6	11	Winckler 1	Huntington Beach
Sy Wicker	10	6	11	1	Huntington Beach
Wilshire Oil Co., Inc	10	6	11	H. B. 11	Huntington Beach
Wilshire Oil Co., Inc	10	6	11	H. B. 12	Huntington Beach
Wilshire Oil Co., Inc	10	6	11	H. B. 13	Huntington Beach
Wilshire Oil Co., Inc	10	6	11	H. B. 14	Huntington Beach
Wilshire Oil Co., Inc	10	6	11	H. B. 16	Huntington Beach
Wilshire Oil Co., Inc	10	6	11	H. B. 17	Huntington Beach
Wilshire Oil Co., Inc	10	6	11	H. B. 18	Huntington Beach
World Petroleum Corp	10	6	11	Mathews & Berman 4	Huntington Beach
Associated Oil Co	33	3	9	Bayha 5	Richfield
Associated Oil Co	33	3	9	Kammerer 5	Richfield
Berry and Todd	34	3	9	Thurston 1	Richfield
California Petroleum Corp	33	3	9	Krug 8	Richfield
California Petroleum Corp	34	3	9	Richfield Cons. 13	Richfield
California Petroleum Corp	34	3	9	Richfield Cons. 14	Richfield
C. C. M. O. Co	33	3	9	7-R	Richfield
C. C. M. O. Co	33	3	9	8-R	Richfield
Continental Oil Co	33	3	9	5	Richfield
Continental Oil Co	30	3	9	Kraemer 4	Richfield
E. L. Cragen	28	3	9	1	Richfield
Delaney Petroleum Co	27	3	9	4	Richfield
General Petroleum Corp	33	3	9	Hugo 7	Richfield
General Petroleum Corp	33	3	9	Mullen 3	Richfield
General Petroleum Corp	33	3	9	Mullen 4	Richfield
General Petroleum Corp	28	3	9	Thompson 10	Richfield
Standard Oil Co	34	3	9	Anaheim Union 2	Richfield
Standard Oil Co	34	3	9	Moll. Comm. 1	Richfield
Superior Oil Co	33	3	9	Etchandy 1	Richfield
Union Oil Co	29	3	9	Chapman 27	Richfield
Union Oil Co	33	3	9	Stern 6	Richfield
Union Oil Co	33	3	9	Stern 7	Richfield

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
ORANGE COUNTY—Continued.					
Union Oil Co.	33	3	9	Stern 8	Richfield
Union Oil Co.	28	3	9	Thompson and Goodwin 9	Richfield
Union Oil Co.	34	3	9	Yorba Linda Group 14	Richfield
RIVERSIDE COUNTY:					
L. R. Clark	5	3	2	2	
SAN BENITO COUNTY:					
Betabel Fruit Farm	Sub. B of Lot 6, Rancho of San Antonio			1	
SAN BERNARDINO COUNTY:					
R. A. Nickell	9	3	7	McCarty 1	
Painted Hills Oil Assn.	34	30	10	Pecho 1	
The United Oil Co.	10	29	17	Wreden 1	
SAN MATEO COUNTY:					
Shell Co.	8	6	5	Cowell 1	
SANTA BARBARA COUNTY:					
Palmer Union Oil Co.	30	9	32	Stendel 9	Cat Canyon
Union Oil Co.		9	34	Coast 13	Santa Maria
Smith and Barmore		4	26	4	Summerland
Miley Oil Co.	3	4	29	Goleta 2	
Miley Oil Co.	4	4	29	Goleta 3	
Levi Smith	3	4	29	1-A	
SANTA CRUZ COUNTY:					
J. R. Dorsey	23	11	2	Galletly 1	
TULARE COUNTY:					
J. W. Grafford	26	24	24	19	
VENTURA COUNTY:					
B. B. & N. Oil Co.	13	4	19	10	Piru
Edward A. Logsdon	14	4	19	King Tut 1	Piru
Schell and Jennings	32	4	18	10	Piru
Big Six Petroleum Co.	19	4	19	1	Sespe
Clampitt and Withrow	1	4	20	9	Sespe
H. A. Ivers	1	4	20	9	Sespe
H. A. Ivers	1	4	20	10	Sespe
R. F. Labonge	1	4	20	Star 6	Sespe
Shell Co.	33	3	20	Berylwood 2	Simi
Oak Ridge Oil Co.	13	3	21	Harvey 19	South Mountain
Oak Ridge Oil Co.	13	3	21	Harvey 21	South Mountain
Associated Oil Co.	23	3	23	Dabney-Lloyd 1	Ventura
Associated Oil Co.	22	3	23	Hartman 6	Ventura
Associated Oil Co.	27	3	23	Lloyd 44	Ventura
Associated Oil Co.	27	3	23	Lloyd 50	Ventura
Bolsa Chica Oil Co.	21	3	23	Louis Hartman 3	Ventura
C. C. M. O. Co.	16	3	24	1-B	Ventura
General Petroleum Co.	21	3	23	Barnard 11	Ventura
General Petroleum Co.	28	3	23	Barnard 15	Ventura
G. J. Magenheimer	22	3	23	Hartman 1-A	Ventura
Miley Oil Co.	7	3	23	Casitas 2-A	Ventura
Petroleum Securities Co.	28	3	23	Orton 2	Ventura
Petroleum Securities Co.	28	3	23	Orton 3	Ventura
Petroleum Securities Co.	28	3	23	Willett 2	Ventura
Shell Co.	28	3	23	Edison 14	Ventura
Shell Co.	28	3	23	Edison 15	Ventura
Shell Co.	28	3	23	Taylor 17	Ventura
Shell Co.	28	3	23	Taylor 19	Ventura
Shell Co.	28	3	23	Taylor 20	Ventura
Shell Co.	28	3	23	Taylor 21	Ventura

SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff and others are published in each number of 'Mining in California.'

These special articles cover a wide range of subjects, both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

MANGANESE ORE PRODUCERS' COMMITTEE.

Immediately following the adjournment of the meeting of the American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio, on April 20, 1927, a voluntary committee of American producers of manganese ore was formed for the purpose of protecting and advancing the interests of domestic producers. The committee is as follows:

J. Carson Adkerson, Woodstock, Virginia.
N. H. Mannakee, Bluefield, West Virginia.
H. A. Pompelly, Oswego, New York.
J. H. Cole, Phillipsburg, Montana.
Wm. D. Meyering, City Hall, Chicago, Ill.

All persons interested in American manganese ores are advised to communicate promptly with one of the above named committee so that they may receive information and be notified of a convention to be called at an early date to advance the interests of producers of manganese ores in America.

BIBLIOGRAPHY OF CLAY DEPOSITS IN CALIFORNIA.

A new bulletin on the clay resources of the state is now in course of preparation by Mr. W. F. Dietrich, Ceramic Engineer. In the meantime there is no single publication of the State Mining Bureau in print devoted to this subject. The following compilation of references has been prepared, therefore, with the idea of offering a means of ready reference to descriptions of clay deposits reported upon in the various publications of the State Mining Bureau. All of the publications listed may be consulted in the main and branch offices of the State Mining Bureau and in many public libraries. A list of those available for distribution will be sent upon request.

California State Mining Bureau Publications Relating To Clay Deposits.

Reports.

First Report of the State Mineralogist, 1880, pp. 36–38.
Fourth Report of the State Mineralogist, 1884, pp. 139–146.
Eighth Report of the State Mineralogist, 1888, pp. 16, 108, 116, 159, 161, 342, 415, 529, 557, 561, 631, 635, 636, 690.

Ninth Report of the State Mineralogist, 1889, pp. 287–308.
Tenth Report of the State Mineralogist, 1890, pp. 236, 265, 314, 413, 625.
Eleventh Report of the State Mineralogist, 1892, pp. 146–149, 252, 321, 471.
Twelfth Report of the State Mineralogist, 1894, pp. 381–384.
Thirteenth Report of the State Mineralogist, 1896, pp. 612–620.
Fourteenth Report of the State Mineralogist, 1914, pp. 4, 5–11, 56, 178, 197, 204, 244, 300, 316, 367, 379, 380, 391, 392, 415, 605, 607, 629, 737, 738, 756, 816.
Fifteenth Report of the State Mineralogist, 1916, pp. 256, 260, 322–326, 424, 488–499, 559–574, 596, 630, 860, 905.
Seventeenth Report of the State Mineralogist, 1920, pp. 76, 149, 166, 184, 234, 256, 257, 307, 317, 323, 325, 338, 375, 412, 441.
Eighteenth Report of the State Mineralogist, 1922, pp. 215, 523, 554–557.
Nineteenth Report of the State Mineralogist, 1923, pp. 94–96, 164, 185–210.
Twentieth Report of the State Mineralogist, 1924, pp. 46, 368.
Twenty-first Report of the State Mineralogist, 1925, pp. 2, 29, 64–66, 167, 177, 190, 204, 236, 287, 302, 354, 505, 546, 579.
Twenty-second Report of the State Mineralogist, 1926, pp. 78, 131, 228, 268, 317, 332, 513, 560.

Bulletins.

Bulletin No. 38, Structural and Industrial Materials of California, 1906, pp. 190–259.

Preliminary Reports.

No. 7, The Clay Industry in California, 1920.

Statistics.

Statistics of Production and Value in Annual Statistical Bulletins.
California Mineral Production for 1925, and previous annual issues.



ADMINISTRATIVE DIVISION.

WALTER W. BRADLEY, Deputy State Mineralogist.

Personnel.

There have been no changes of personnel to be noted during the past quarter.

New Publications.

During the quarterly period covered by this issue, the following Bureau publications have been made available for distribution:

Mining in California (quarterly), October, 1926, being Chapter 4 of State Mineralogist's Report XXII. Price 25 cents.

Summary of Operations, California Oil Fields: Vol. 12, Nos. 4 and 5, for October and November, 1926, respectively.

Commercial Mineral Notes: Nos. 48, 49, 50, February-April (inc.). These 'notes' carry the lists of 'mineral deposits wanted' and 'minerals for sale' issued in the form of a mimeographed sheet monthly. It is mailed free to those on the mailing list for 'Mining in California.'

Mails and Files.

The Bureau maintains, in addition to its correspondence file and the library, a mine file which includes original reports on the various mines and mineral properties of all kinds in California.

During the period covered by this quarterly report, there were 2006 letters received and answered at the San Francisco office alone, covering almost every phase of prospecting and developing mineral deposits, reduction problems, marketing of refined products and mining law.

DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum Laboratory.

WALTER W. BRADLEY, Deputy State Mineralogist.

STATISTICS.

California continues to produce commercially, as for some years past, more than 50 different mineral substances, the total value of which for 1926 was estimated at $456,408,000 (see January issue of MINING IN CALIFORNIA, page 118, ante).

At the present writing (May 1st), reports are in hand from most of the producers. Data for several substances are now complete and have been compiled, being presented herewith.

Information at hand indicates that there was no production in California during 1926 of the following substances, which have at one time or another in the past been on the active list here: Arsenic, bismuth, fluorspar, graphite, mica, molybdenum, serpentine, sulphur, strontium, tin. There was production by a single operator in each of the following: Andalusite, antimony, asbestos, bromide, cyanite and lithia, the figures for which will have to be combined under the 'unapportioned' item in the final report. The production of bromine from salt-works bittern waters is the first, in commercial quantity, of record in California.

BARYTES.

Commercial shipments of crude barytes in California amounted to a total of 4978 tons, valued at $38,165 f.o.b. rail-shipping point, coming from properties in Nevada and Mariposa counties. The material was consumed principally in the manufacture of lithopone. The new plant of the Chemical and Pigments Company at Oakland, Alameda County, with a capacity for 25 tons of lithopone daily, began operations during the year. This plant will thus afford an outlet for some of California's zinc ore as well as for barytes.

More than half of the total tonnage of barytes utilized in the United States is taken in the manufacture of lithopone, which is a chemically-prepared white pigment containing approximately 70% barium sulphate and 30% zinc sulphide. This is one of the principal constituents of 'flat' wall paints. Other important uses for barytes, after washing and grinding, are as an inert pigment and filler in paint, paper, linoleum, oilcloth and rubber manufacture, and in the preparation of a number of chemicals including barium binoxide, carbonate, chloride, nitrate, and the sulphate precipitated, or 'blanc fixe.'

BITUMINOUS ROCK.

This material is essentially an uncemented sandstone which is saturated with and held together by a natural asphaltic constituent, probably the residue from the evaporation of a crude petroleum deposit. Bituminous rock is still used to a limited extent for road dressing in those districts adjacent to available deposits, though the manufacture of asphalt at the oil refineries has almost entirely superseded the direct use of the native material. The present operators of the old City Street Improvement Company's quarry in Santa Cruz County advise that they are now putting on the market a material which can be laid cold. It will be especially applicable and valuable for patching jobs.

Shipments from quarries in Santa Barbara and Santa Cruz counties in 1926 totaled 3863 tons of bituminous rock, valued at $21,577 f.o.b. rail-shipping point, being an increase over the 1925 shipments.

CEMENT.

Cement is the most important single structural material in the mineral output of California. During 1926 there was produced a total of 13,797,173 barrels, valued at $25,269,678, f.o.b. plant; being an increase of over half a million barrels in quantity, but only slightly in total value owing to a small drop in prices. The 1925 output was 13,206,630 barrels, valued at $25,043,335, or an average of $1.90 per barrel. The 1926 average was $1.84 per barrel.

The 1926 production came from eleven operating plants in nine counties, and employing a total of 3047 men. The three plants in San Bernardino County made a total of 5,135,840 barrels, valued at $9,273,627, the balance of the state's product coming from a single plant in each of the following counties: Calaveras, Contra Costa, Kern, Riverside, San Benito, San Mateo, Santa Cruz and Solano. The new plant of the Calaveras Cement Company near San Andreas, Calaveras County, began operation and commercial shipments in 1926. Recent press notices record the consolidation of the Pacific Portland Cement Corporation, operating cement plants in San Mateo and Solano counties, and a gypsum plant in Imperial County, with the Old Mission Portland Cement Company, operating at San Juan, San Benito County.

MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections in North America; and contains not only specimens of most of the known minerals found in California, but much valuable and interesting material from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well as by those who utilize the facilities of the collection.

The exhibit is daily visited by engineers, students, business men and prospectors as well as tourists and mere sightseers. Besides its practical use in the economic development of California's mineral resources, the collection is a most valuable educational asset to the state and to San Francisco.

LABORATORY.

FRANK SANBORN, Mineral Technologist.

Samples of sandstone containing the black sulphide of mercury, metacinnabarite, have recently been submitted to this Bureau from near Skaggs Springs in Sonoma County. At this deposit the metacinnabarite occurs in small black amorphous masses disseminated through the rock; little or no cinnabar is associated with the black sulphide. The percentage of mercury present in this ore is apparently high enough for a commercial grade of quicksilver, provided the deposit proves to be sufficiently large. Metacinnabarite will concentrate in panning, giving a dark colored concentrate; otherwise it is an inconspicuous mineral when occurring as black specks penetrating a rock.

The most important deposits of cinnabar so far discovered in California occur in the Coast Range, extending from Del Norte County to San Diego County. Samples of black sand received from some of these counties for platinum tests usually contain a small amount of cinnabar. The present trend of prices of quicksilver and platinum metals suggests the feasibility of prospecting this territory again, not for platinum, but for quicksilver. The suggestion has been made in some of our laboratory reports that the sender attempt to find the source of the cinnabar present in the sample submitted.

The present high price of mercury has apparently stimulated the prospecting for this metal. At least one new deposit of cinnabar has been found in Napa County during the past year.

During the three-month period covered by this report samples have been received from practically every county in the state, 1159 determinations having been made.

LIBRARY.

E. A. Lowe, Librarian.

In addition to the numerous standard works, authorative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the State Mining Bureau contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the State are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

OFFICIAL PUBLICATIONS RECEIVED.

Governmental.

U. S. Geological Survey:

Professional Paper No. 147—Shorter Contributions to General Geology, 1926. By W. C. Mendenhall.

Bulletin No. 783—Annual Resources of Alaska. Report on Progress of Investigation in 1924. By Philip S. Smith and others.

Bulletin No. 785—Contributions to Economic Geology (short papers and preliminary reports), 1926. Part I, Metals and Non-Metals except Fuels. By G. F. Loughlin and G. R. Mansfield.

Bulletin No. 786-B—Geology of the Cat Creek and Devil's Basin Oil Fields and Adjacent Areas in Montana. By Frank Reeves.

Bulletin No. 790-B—The Palouse Soil Problem, with an account of Elephant Remains in Wind-Borne Soil of the Columbia Plateau of Washington. By Kirk Bryan.

Water Supply Paper No. 550—Surface Water Supply of the United States in 1922; Part X, the Great Basin. By N. C. Grover.

Water Supply Paper No. 584—Surface Water Supply of the United States. By Nathan C. Grover.

Water Supply Paper No. 596-A—Methods of Exploring and Repairing Leaky Artesian Wells. By John McCombs and Albert G. Fields.

U. S. Bureau of Mines:

I:11—Manganese and Manganiferous Ores in 1925. By J. W. Furness.

I:15—Gold, Silver, Copper, Lead and Zinc in New Mexico and Texas in 1925. Mines Report. By Chas. W. Henderson.

I:16—Silver, Copper, Lead and Zinc in the Central States in 1925. Mine Report. By J. P. Dunlop and H. H. Meyer.

I:17—Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1925 Mine Report. By James M. Hill.

II: 3—Fuller's Earth in 1925. By Jefferson Middleton.

II: 8—Asbestos in 1925. By Blanche H. Stoddard.
II: 9—Slate in 1925. By A. T. Coons.
II:10—Magnesium and Its Compounds in 1925. By J. M. Hill.
II:13—Clay in 1925. By Jefferson Middleton.
II:21—Talc and Soapstone in 1925. By Blanche H. Stoddard.
II:22—Potash in 1925. By A. T. Coons.
II:23—Stone in 1925. By A. T. Coons.
II:25—Sand and Gravel in 1925. By Estelle R. Phillips.
II:26—Silica in 1925. By Frank J. Katz.
II:30—Coal in 1924. By James E. Black, L. Mann and F. G. Tyson.

Technical Paper No. 375—Effects of the Corona Discharge on Petroleum. By J. J. Jakosky.
No. 381—Heavy Liquids for Mineralogical Analyses. By John D. Sullivan.
No. 383—Blasting to Lessen Boulders in Hard Ore Stopes. By E. D. Gardener and S. P. Howell.
No. 385—Typical Methods and Devices for Handling Oil-contaminated Water from Ship and Industrial Plants. By F. W. Lane and A. D. Bauer, H. T. Fisher and P. N. Harding.
No. 386—Explosibility of Coal Dust from Mines in Utah. By H. P. Greenwald.
No. 387—Engine Service Tests of Internal Combustion Engine Lubricating Oils made from California Crude Oil. By Martin J. Gavin and Gustave Wade.
No. 389—Lead Poisoning in the Mining of Lead in Utah. By Arthur L. Murray.
No. 394—Dust Respirators, Their Construction and Filtering Efficiency. By S. H. Katz, G. W. Smith and E. G. Meiter.

Reports of Investigations:
Serial No. 2793—Sources of Dust in Coal Mines. By J. J. Forbes and Alden H. Emery.
Serial No. 2794—Some Feldspathic Materials of the Pacific Northwest. By Hewitt Wilson.
Serial No. 2795—Fifteenth Semi-Annual Motor Gasoline Survey. By E. C. Lane and Peter Grandone.
Serial No. 2796—Coal Mine Fatalities in January, 1927. By W. W. Adams.
Serial No. 2797—Consumption of Explosives in January, 1927. By W. W. Adams.

Circular No. 6020—One Hundred Percent of the Employees of Two Large Illinois Coal Mines Trained in First Aid.
Circular No. 6021—List of Permissible Mining Equipment.

Alabama—General Summary of Mineral Production for 1924. By Walter B. Jones.

Arizona Bureau of Mines. Bulletin 119, Geo. Series No. 3—A Resume of Arizona Geology. By N. H. Darton.

California—
Report of the Division of Architecture, Dept. of Public Works of State. Part IV.
Biennial Report of the Division of Water Rights, a Subdivision of the Dept. of Public Works of the State. By Edw. Hyatt, Jr.
Sacramento Flood Control Project, Revised Plan. Maps and Profiles.

Connecticut—State Geology and Natural History—
Bulletin No. 36—The Uredinales or Rusts of Connecticut and the Other New England States. By Willis R. Hunt, Ph. D.
Bulletin No. 37—Catalogue of the Lichens of Connecticut. By Alex. W. Evans, Ph. D.
Survey Bulletin No. 37—Catalogue of the Lichens. By Alex. Wm. Evans.

Idaho Bureau of Mines and Geology:
Bulletin No. 11, Dec., 1926—Geology and Metalliferous Resources of the Region About Silver City, Idaho. By Arthur M. Pipe and Francis B. Laney.
Pamphlet 19, Jan., 1927—Geologic Reconnaissance of Clark and Jefferson and Parts of Butte, Custer, Fremont, Lemhi and Madison Counties, Idaho. By R. D. Kulsham.
A Disseminated Lead Prospect in Northern Boise County, Idaho. By Clyde P. Ross.

Illinois State Geological Survey. Dept. of Registration and Education:

Bulletin No. 49, State of Illinois.

Press Bulletin No. 8—Oil Possibilities of the Alexis Quadrangle, Mercer and Warren Counties, Illinois. By Harold R. Wanless.

Press Bulletin No. 7—Illinois Petroleum. By Ben H. Cox.

Iowa Geological Survey, Vol. XXXI, Annual Reports 1923-1924, with accompanying papers. By Geo. F. Kay, Ph. D., State Geologist.

Kentucky Geological Survey. By Prof. L. C. Robinson.

New Oil Pools of Kentucky. By Willard Rouse Jillson.

Missouri Bureau of Geology and Mines. Personal Report of the State Geologist.

Vol. IX, No. 4—School of Mines, Univ. of Missouri. Descriptive Bibliography on Oil Fluid Flow and Heat Transfer in Pipes. By Joe B. Butler.

North Carolina, Dept. of Conservation and Development, Div. of Forestry. Circular No. 17—Program of American Forest Week. By J. W. Sebring.

Ohio, Geological Survey of. By J. A. Bownocker, State Geologist.

Bulletin No. 30, Fourth Series—Geology of Delaware County. By Lewis G. Westgate, Ph. D.

Pennsylvania Geological Survey. Bull. M-9—Slate in Northampton County. By Chas. H. Behre, Jr.

South Dakota Geological and Natural History:

Survey Circular No. 28—Structures in Western Haakon and Eastern Pennington Counties. By Wm. Russell.

Survey Circular No. 29—A Preliminary Report of a Biological Survey of the Lakes of South Dakota. By Wm. H. Over and Edw. P. Churchill.

Circular No. 26—Sand and Gravel Deposits of Minnehaha County.

Circular No. 27—The Possibilities of Oil in Western Carson County. By. Wm. L. Russell.

Circular H—Sand and Gravel Deposits of Yankton County. By E. P. Rothrock.

Biennial Report of State Geologist, 1924-26.

Tennessee, Dept. of Education, Div. of Geology:

Bulletin 32-E—Coal Losses of Tennessee. By J. J. Forbes.

Bulletin 33-A—The Southern Tenn. Coal Fields. By Wilbur A. Nelson.

Bulletin 33-C—The Coals and Geology of the Herbert Domain. By Wilbur A. Nelson.

Bulletin 33-D—Geology and Mineral Resources of the Crossville Quadrangle. By Chas. Butts and Wilbur A. Nelson.

Bulletin 36—The Valley of East Tennessee; the Adjustment of Industry to Natural Environment. By Earl C. Case.

Vermont—Report of State Geologist on Mineral Industries and Geology, 1925–26—15th of this series. Geo. H. Perkins, State Geologist.

Washington—Third Biennial Report of Dept. of Conservation and Dev. from April 1, 1925 to Sept. 30, 1926. By Earl J. Barnes, Dir.

West Virginia—Grant Counties. Paleontology of Minerals.

Canada, Dept. of Mines, Mines Branch:

No. 632—Bituminous Sands of Northern Alberta—Occurrences and Econ. Possibilities. By S. C. Ellis. Topographical Maps to accompany.

No. 679—Helium in Canada. By R. T. Elworthy.

14th Ed. Catalogue of Mines Branch Publications.

Summary Report 1925, Part B, Geological Survey.

Bulletin No. 43, Biological Series No. 11, Mar. 22, 1926. Victoria Memorial Museum. List of Mushrooms and other Fleshy Fungi of the Ottawa Dist. By W. S. O'Dell.

Bulletin No. 2113, Part C, Summary Report, 1925, Geological Survey.

No. 669—Investigations of Mineral Resources and the Mining Industry, 1925.

No. 670—Investigations in Ore Dressing and Metallurgy (testing and research laboratories).

No. 672—Investigations in Ceramics and Road Materials (testing and research laboratories).

No. 2093—Geological Series No. 3. The Iron Ores of Canada, British Columbia and Yukon. By G. W. Young.

Nova Scotia. Report on the Mines, 1926.

Quebec, Dept. of Colonization, Mines and Fisheries. Preliminary Statement on Mineral Production During 1926.

Ontario:

Bulletin No. 60—Preliminary Report on Mineral Production in 1926. By W. R. Rogers and A. C. Young. Dept. of Mines.

35th Annual Report of Ontario Dept. of Mines, Vol. XXXV, Part II, 1926.

Bulletin No. 46—(Rev. Ed., Dec., 1926).

Hydro Electric Development for Metal Mines of Northern Ontario. By A. R. Webster, inspector of mines.

New Zealand, Dept. of Internal Affairs. 59th Annual Report of the Dominion Laboratory. By J. S. Maclaurin.

West Australia:

Geological Survey Bulletin No. 88—Palcontological Contributions to Geology of Western Australia. Series VII, Nos. XIII, XIV, XV. By Rex. W. Bretnall, F. Chapman and Ludwig Glauert.

Geological Survey Bulletin No. 91—The Auriferous Lodes of the Gibraltar Dist., Coolgardie Goldfield. By F. R. Freldtmann.

Bull. de la Commission Geologique de Finlande No. 77. By J. J. Sederholm.

Transvaal Chamber of Mines. Reports of Executive Committee, Gold Producers' Committee and Collieries Committee for year 1926.

Republica Argentina Ministerio De Agricultura De La Nacion Publicacion No. 23. Geologia Economica de los yacimientos de boratos y materiales de las cercucas.

Publicacion No. 24—Contribution al conocuniento de los Fenomenos geofisicos atmosfericos.

Publicacion Nos. 25-26—Condiciones Geologicas.

Publicacion No. 27—Sobre Las Posibilidades de Una Industria Sederurgica en la Republica Argentina.

The Geology and Mineral Resources of South Manchuria.

Societies and Educational Institutions.

American Mineralogist, Journal of the Mineralogical Society of America. Vol. XII, Nos. 1, 3, 1927. By Walter F. Hunt.

Geographical Review, April, 1927.

American Institute of Mining and Metallurgical Engineers:

Vol. CVI LXXII, inc., 1917 1925. General Alphabetical and Analytical Index Transactions of the Amer. Inst. of Mining and Metallurgical Engineers.

Vol. LXXIV—Transactions of.

Mining and Metallurgical Society of America:

Bulletin No. 162—Reports of the sub-committees on Petroleum, Chrome and Graphite in connection with the Committee on Foreign and Domestic Mining Policy, Sept., 1923. Vol. XVI, No. 5.

Bulletin No. 170—Explorations in the Gobi Desert, May-June, 1924. Vol. XVII, No. 5.

Bulletin No. 188—Study of Mineral Resources and Reserves Joint Meeting with A. J. M. E., Feb.-Mar., 1927. Vol. XX, No. 2.

The Institution of Mining and Metallurgy. No. 269, Feb., 1927. No. 271, April, 1927.

Bulletin No. 270, March, 1927.

Journal of the Western Society of Engineers, Vol. XXXII, Nos. 1, 2, 3, 1927.

Proceedings of the Engineers' Society of Western Pennsylvania. Vol. 42, No. 10, Jan., 1927. Vol. 42, No. 8, Nov., 1926.

The Canadian Mining and Metallurgical Bulletin.

The Canadian Institute of Mining and Metallurgy.

The Canadian Mining and Metallurgical Bulletin No. 180.

The Philippine Journal of Science, Vol. 32, Nos. 1, 2, 3.

The Proceedings of the American Philosophical Society. Vol. LXV, 1926, No. 5.

Proceedings of Academy of Natural Sciences of Philadelphia. Vol. LXXVII, 1926.

Estados Anidos Mexicanos, Estadistica Nacional.

Societara de Industria Commercio of Trabajo Boletin del Potroleo. Vol. XXIII, Enero D 1927, No. 1.

Records of the Australian Museum. Vol. XV, Nos. 4 and 5.

Bulletin of the Geological Institution of the Univ. of Uprala. H. J. Sjogren.

Boletin Do Museu Nacional Do Rio De Janeiro. Vol. II, No. 3, Sept., 1926.

Estradistica Nacional Revista Quincenal. Ano. III, 50, 1927, Feb., 28. Ano. III, 19, 1927, Feb. 15.
Journal of the Faculty of Engineering Tokyo Imperial Univ. Vol. XVI, No. 12.
Economic Geology. Vol. XXII, No. 2, March and April.

Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

American Petroleum Institute, New York.
Architect and Engineer, San Francisco.
Arizona Mining Journal, Phoenix, Arizona.
Asbestos, Philadelphia, Pennsylvania.
Brick and Clay Record, Chicago.
Bulletin, Union Oil Co., Los Angeles.
California Journal of Development, San Francisco.
Cement, Mill and Quarry, Chicago, Illinois.
Chemical-Engineering and Mining Review, Melbourne, Australia.
Engineering and Mining Journal-Press, New York.
Explosives Engineer, Wilmington, Del.
Financial Insurance News, Los Angeles, California.
Graphite, Jersey City.
Journal of Electricity and Western Industry, San Francisco.
Metallurgical and Chemical Engineering, New York.
Mine and Quarry, Chicago.
Mining and Engineering Record, Vancouver, B. C.
Mining and Oil Bulletin, Los Angeles.
Oil Age, Los Angeles.
Oil and Gas Journal, Tulsa, Oklahoma.
Oil and Gas News, Kansas City.
Oil News, Galesburg, Illinois.
Oildom, New York.
Oil, Paint and Drug Reporter, New York.
Oil Trade Journal, New York.
Oil Weekly, Houston, Texas.
Petroleum Age, New York.
Petroleum Record, Los Angeles.
Petroleum World, Los Angeles.
Queensland Government Mining Journal, Brisbane, Australia.
Rock Products, Chicago, Illinois.
Safety News, Industrial Accident Commission, San Francisco.
Salt Lake Mining Review, Salt Lake City, Utah.
Southwest Builder and Contractor, Los Angeles
Standard Oil Bulletin, San Francisco.
Stone, New York.
The Record, Associated Oil Company, San Francisco.
Through the Ages, Baltimore.

Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.
Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).
Barstow Printer, Barstow, Cal.
Blythe Herald, Blythe, Cal.
Bridgeport Chronicle-Union, Bridgeport, Mono Co., Cal
Calaveras Prospect, San Andreas, Cal.
California Oil World, Los Angeles, Cal.
Cloverdale Reveille, Cloverdale, Cal.
Colusa Daily Sun, Colusa, Cal.
Daily Commercial News, San Francisco, Cal.
Daily Midway Driller, Taft, Cal.
Del Norte Triplicate, Crescent City, Cal.
Exeter Sun, Exeter, Cal.

Gateway Gazette, Beaumont, Cal.
Goldfield News, Goldfield, Nevada.
Guerneville Times, Guerneville, Cal.
Healdsburg Enterprise, Healdsburg, Cal.
Humboldt Standard, Eureka, Cal.
Inyo Independent, Independence, Cal.
Inyo Register, Bishop, Cal.
Ione Valley Echo, Ione, Cal.
Lake County Bee, Lakeport, Cal.
Mining and Financial Record, Denver, Colo.
Mining Topics, San Francisco, Cal.
Mountain Democrat, Placerville, Cal.
Mountain Messenger, Downieville, Cal.
Nevada City Nugget, Nevada City, Cal.
Nevada Mining Press, Reno, Nevada.
Oatman Mining News, Oatman, Arizona.
Oregon Observer, Grants Pass, Oregon.
Oroville Daily Register, Oroville, Cal.
Petroleum Reporter, Taft, Cal.
Placer Herald, Auburn, Cal.
Plumas Independent, Quincy, Cal.
Plumas National Bulletin, Quincy, Cal.
Randsburg Times, Randsburg, Cal.
San Diego News, San Diego, Cal.
Shasta Courier, Redding, Cal.
Siskiyou News, Yreka, Cal.
Stockton Record, Stockton, Cal.
Tuolumne Prospector, Tuolumne, Cal.
Ventura Daily Post, Ventura, Cal.
Weekly Trinity Journal, Weaverville, Cal.
Western Sentinel, Etna Mills, Cal.

PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

When the publication of MINING IN CALIFORNIA was on a monthly basis, current inquiries from buyers and sellers were summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to the present quarterly publication of MINING IN CALIFORNIA, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes.'

EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate attention.

The Bureau registers technical men, or those qualified for supervisory positions, and vacancies of like nature, only, as no attempt will be made to supply common mine and mill labor.

A list of current applications for positions and 'positions open' is carried in each issue. Notices are designated by a key number, and the name and address corresponding to any number will be supplied upon request, without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Bureau, to avoid possible loss. Registration cards for the use of both prospective employers and employees may be obtained at any office of the Bureau upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

POSITIONS WANTED.

51–5 Mine Accountant. Twelve years experience time-keeping, cost sheet work, etc., for large copper mining company, coupled with knowledge of actual mine work. Age 54. Married. References. Salary wanted, $150 to start.

PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

During the past forty-four years, in carrying out the provisions of the organic act creating the California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the Bureau's offices in the Ferry Building, San Francisco; New Orpheum Building, Los Angeles; Chamber of Commerce Building, Sacramento; Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications of the Bureau, from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the offices of the State Mining Bureau and enclosing the requisite amount in the case of publications that have a list price. The Bureau is authorized to receive only coin, stamps or money orders, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the State Mining Bureau.

REPORTS.

Asterisks (**) indicate the publication is out of print.

	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks	----
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks	----
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks	----
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks	----
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks	----
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. Henry G. Hanks	----
**Part II, 1887, 222 pp., 36 illustrations. William Irelan, Jr.	----
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Irelan, Jr.	----
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustrations. William Irelan, Jr.	----
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Irelan, Jr.	----
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Irelan, Jr.	----

REPORTS—Continued.

Asterisks (**) indicate the publication is out of print.

Price

Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps. William Irelan, Jr. $1.00

**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps. J. J. Crawford ----

**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford ----

Chapters of the State Mineralogist's Report, Biennial Period, 1913-1914, Fletcher Hamilton:

**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper ----

Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper .50

Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper .25

**Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pages, paper ----

Mines and Mineral Resources of Imperial and San Diego Counties, 113 pp., paper .35

**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper ----

**Fourteenth Report of the State Mineralogist, for the Biennial Period 1913-1914, Fletcher Hamilton, 1915:

A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth ----

Chapters of the State Mineralogist's Report, Biennial Period, 1915-1916, Fletcher Hamilton:

**Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp., paper ----

**Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama Counties, 91 pp., paper ----

Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper .65

Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper .65

Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties, 136 pp., paper .50

**Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp., paper ----

**Fifteenth Report of the State Mineralogist, for the Biennial Period 1915-1916, Fletcher Hamilton, 1917:

A General Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp., 413 illustrations, cloth ----

Chapters of the State Mineralogist's Report, Biennial Period 1917-1918, Fletcher Hamilton:

Mines and Mineral Resources of Nevada County, 270 pp., paper .75

Mines and Mineral Resources of Plumas County, 188 pp., paper .50

Mines and Mineral Resources of Sierra County, 144 pp., paper .50

Seventeenth Report of the State Mineralogist, 1920, Mining in California during 1920, Fletcher Hamilton: 562 pp., 71 illustrations, cloth 1.75

Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with January, 1922:

REPORTS—Continued.

Asterisks (**) indicate the publication is out of print. Price

**January, **February, March, April, May, June, July, August, September, October, November, December, 1922 ---- Free

Chapters of Nineteenth Report of the State Mineralogist, 'Mining in California,' Fletcher Hamilton and Lloyd L. Root. January, February, March, September, 1923 ---- Free

Chapters of Twentieth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly. January, April, July, October, 1924, per copy ---- $0.25

Chapters of Twenty-first Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly.

January, 1925, Mines and Mineral Resources of Sacramento, Monterey and Orange counties ---- .25

April, 1925, Mines and Mineral Resources of Calaveras, Merced, San Joaquin, Stanislaus and Ventura counties ---- .25

July, 1925, Mines and Mineral Resources of Del Norte, Humboldt and San Diego counties ---- .25

October, 1925, Mines and Mineral Resources of Siskiyou, San Luis Obispo and Santa Barbara counties ---- .25

Subscription, $1.00 in advance (by calendar year, only).

Chapters of Twenty-second Report of the State Mineralogist, 'Mining in California.' Lloyd L. Root. Published quarterly.

January, 1926, Mines and Mineral Resources of Trinity and Santa Cruz counties ---- .25

April, 1926, Mines and Mineral Resources of Shasta, San Benito and Imperial counties ---- .25

July, 1926, Mines and Mineral Resources of Marin and Sonoma Counties ---- .25

October, 1926, Mines and Mineral Resources of El Dorado and Inyo counties .25

Chapters of Twenty-third Report of the State Mineralogist, 'Mining in California.' Lloyd L. Root. Published quarterly.

January, 1927, Mines and Mineral Resources of Contra Costa County; Santa Catalina Island ---- .25

Chapters of State Oil and Gas Supervisor's Report:

Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume) ---- Free

Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:

**April, **May, June, **July, **August, **September, **October, November, **December, 1919 ---- Free

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January, February, March, April, May, June, July, August, September, October, November, December, 1925 ---- Free

January, February, March, April, May, June, July, August, September, October, November, December, 1926 ---- Free

BULLETINS.

Asterisks (**) indicate the publication is out of print.

**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations ---- ----

**Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations ---- ----

**Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps ---- ----

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print. Price

**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.) ----

**Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations ----

Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations $0.50

**Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 9. Mine Drainage, Pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations ----

**Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp. ----

**Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps, 31 illustrations ----

**Bulletin No. 12. Mineral Production of California, by Counties for 1896, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 13. Mineral Production of California, by Counties for 1897, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 14. Mineral Production of California, by Counties for 1898, by Charles G. Yale ----

**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H. Means. 1899 ----

**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations ----

**Bulletin No. 17. Mineral Production of California, by Counties for 1899, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations ----

**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps ----

**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years ending December, 1899 ----

**Bulletin No. 21. Mineral Production of California by Counties, by Charles G. Yale. 1900. Tabulated sheet ----

**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet ----

Bulletin No. 23. The Copper Resources of California, by P. C. DuBois, F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69 illustrations, and 9 maps .50

**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps ----

**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 26. Mineral Production of California for the past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet ----

**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps ----

**Bulletin No. 28. Mineral Production of California, for 1902, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet ----

**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology, and Mineral Resources of California, by A. W. Vogdes. 1903, 290 pp. ----

**Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N. Cooper. 1904. Tabulated sheet ----

**Bulletin No. 32. Production and Use of Petroleum in California, by Paul W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps ----

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**Bulletin No. 33. Mineral Production of California, by Counties, for 1903, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 34. Mineral Production of California for Seventeen Years, by Charles G. Yale. 1904. Tabulated sheet	----
**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale. 1904, 55 pp., 20 county maps. Relief map of California	----
**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905, 120 pp., 66 illustrations, 3 maps	----
**Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of California, by George F. Kunz. 1905. 168 pp., 54 illustrations	----
**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906, 412 pp., 150 illustrations, 1 map	----
**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet	----
**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles G. Yale. 1905, 54 pp., 20 county maps	----
**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 43. Mineral Production of California for Nineteen Years, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G. Yale. 1907, 31 pp., 20 county maps	----
**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907. 10 pp.	----
Bulletin No. 46. General Index of Publications of the California State Mining Bureau, by Charles G. Yale. 1907, 54 pp.	$0.30
**Bulletin No. 47. Mineral Production of California, by Counties, 1906, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 48. Mineral Production of California for Twenty Years. 1906, by Charles G. Yale	----
**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles G. Yale. 34 pp.	----
Bulletin No. 50. The Copper Resources of California, 1908, by A. Hausmann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp., 74 illustrations. (Revised edition.)	1.00
**Bulletin No. 51. Mineral Production of California, by Counties, 1907, by D. H. Walker. Tabulated sheet	----
**Bulletin No. 52. Mineral Production of California for Twenty-one Years, 1907, by D. H. Walker. Tabulated sheet	----
**Bulletin No. 53. Mineral Production of California for 1907, with County Maps, by D. H. Walker, 62 pp.	----
**Bulletin No. 54. Mineral Production of California, by Counties, by D. H. Walker, 1908. Tabulated sheet	----
**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet	----
**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by D. H. Walker. 78 pp.	----
**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps	----
**Bulletin No. 58. Mineral Production of California, by Counties, by D. H. Walker, 1909. Tabulated sheet	----
**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker, 1909. Tabulated sheet	----
**Bulletin No. 60. Mineral Production for 1909, County Maps and Mining Laws of California, by D. H. Walker. 94 pp.	----
**Bulletin No. 61. Mineral Production of California, by Counties for 1910, by D. H. Walker. Tabulated sheet	----
**Bulletin No. 62. Mineral Production of California for Twenty-four Years, by D. H. Walker, 1910. Tabulated sheet	----

BULLETINS—Continued.

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**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman. 1912, 430 pp., 41 illustrations, 6 maps ----

**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp. ----

**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp. ----

**Bulletin No. 66. Mining Laws of the United States and California. 1914, 89 pp. ----

**Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914, 226 pp. ----

**Bulletin No. 68. Mineral Production for 1913, with County Maps and Mining Laws, by E. S. Boalich. 160 pp. ----

**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps (18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.] ----

**Bulletin No. 70. Mineral Production for 1914, with County Maps and Mining Laws. 184 pp. ----

**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations ----

Bulletin No. 72. The Geologic Formations of California, by James Perrin Smith. 1916. 47 pp. $0.25

Reconnaissance Geologic Map (of which, Bulletin 72 is explanatory), in 23 colors. Scale: 1 inch = 12 miles. Mounted 2.50

**Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the fiscal year 1915–16, by R. P. McLaughlin. 278 pp., 26 illustrations ----

Bulletin No. 74. Mineral Production of California in 1916, with County Maps, by Walter W. Bradley. 179 pp., 12 illustrations Free

**Bulletin No. 75. United States and California Mining Laws, 1917. 115 pp., paper ----

Bulletin No. 76. Manganese and Chromium in California, by Walter W. Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A. Waring. 1918. 248 pp., 51 illustrations, 5 maps, paper .50

Bulletin No. 77. Catalogue of Publications of California State Mining Bureau, 1880–1917, by E. S. Boalich. 44 pp., paper Free

Bulletin No. 78. Quicksilver Resources of California, with a Section on Metallurgy and Ore-Dressing, by Walter W. Bradley, 1918. 389 pp., 77 photographs and 42 plates (colored and line cuts), cloth 1.50

Bulletin No. 79. Magnesite in California, by Walter W. Bradley, 1925, 147 pp., 62 photographs, 11 line cuts and maps, cloth 1.00

Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California. (In preparation.) ----

Bulletin No. 81. Foothill Copper Belt of California. (In preparation.) ----

**Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1916–1917, by R. P. McLaughlin, 1918. 412 pp., 31 illustrations, cloth ----

Bulletin No. 83. California Mineral Production for 1917, with County Maps, by Walter W. Bradley. 179 pp., paper Free

**Bulletin No. 84. Third Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1917–1918, by R. P. McLaughlin, 1918. 617 pp., 28 illustrations, cloth ----

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Bulletin No. 86. California Mineral Production for 1918, with County Maps, by Walter W. Bradley, 1919. 212 pp., paper Free

**Bulletin No. 87. Commercial Minerals of California, with notes on their uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello, 1920. 124 pp., paper ----

Bulletin No. 88. California Mineral Production for 1919, with County Maps, by Walter W. Bradley, 1920. 204 pp., paper Free

**Bulletin No. 89. Petroleum Resources of California, with Special Reference to Unproved Areas, by Lawrence Vander Leck, 1921. 12 figures, 6 photographs, 6 maps in pocket, 186 pp., cloth ----

Bulletin No. 90. California Mineral Production for 1920, with County Maps, by Walter W. Bradley, 1921. 218 pp., paper Free

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print. Price

Bulletin No. 91. Minerals of California, by Arthur S. Eakle, 1923, 328 pp., cloth ---- $1.00

Bulletin No. 92. Gold Placers of California, by Chas. S. Haley, 1923. 167 pp., 36 photographs and 7 plates (colored and line cuts, also geologic map), cloth ---- 1.50

Extra copies of the Geologic Map (in 4 colors) ---- .50

Bulletin No. 93. California Mineral Production for 1922, by Walter W. Bradley, 1923, 188 pp., paper ---- Free

Bulletin No. 94. California Mineral Production for 1923, by Walter W. Bradley, 1924, 162 pp., paper ---- Free

Bulletin No. 95. Geology and Ore Deposits of the Randsburg Quadrangle, by Carlton D. Hulin, 1925. 152 pp., 49 photographs, 13 line cuts, 1 colored geologic map, cloth ---- 2.00

Bulletin No. 96. California Mineral Production for 1924, by Walter W. Bradley, 1925. 173 pp., paper ---- Free

Bulletin No. 97. California Mineral Production for 1925, by Walter W. Bradley, 1926. 172 pp., paper ---- Free

PRELIMINARY REPORTS.

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**Preliminary Report No. 1. Notes on Damage by Water in California Oil Fields, December, 1913. By R. P. McLaughlin. 4 pp. ----

**Preliminary Report No. 2. Notes on Damage by Water in California Oil Fields, March, 1914. By R. P. McLaughlin. 4 pp. ----

Preliminary Report No. 3. Manganese and Chromium, 1917. By E. S. Boalich. 32 pp. ---- Free

Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper ---- Free

Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper ---- Free

**Preliminary Report No. 6. A Review of Mining in California During 1919. Fletcher Hamilton, 1920. 43 pp. Paper ----

**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker, 1920. 102 pp. 24 illustrations. Paper ----

**Preliminary Report No. 8. A Review of Mining in California During 1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922. 68 pp. Paper ----

MISCELLANEOUS PUBLICATIONS.

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**First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 1881. 350 pp. ----

**Catalogue of books, maps, lithographs, photographs, etc., in the library of the State Mining Bureau at San Francisco, May 15, 1884. 19 pp. ----

**Catalogue of the State Museum of California. Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220 pp. ----

**Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31, 1887. 195 pp. ----

**Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August 20, 1890. 261 pp. ----

**Catalogue of the Library of the California State Mining Bureau, September 1, 1892. 149 pp. ----

**Catalogue of West North American and Many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894 ----

**Report of the Board of Trustees for the four years ending September, 1900. 15 pp. Paper ----

MISCELLANEOUS PUBLICATIONS—Continued.

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Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper ---- Free

Commercial Mineral Notes. A monthly mimeographed sheet, beginning April, 1923 ---- Free

MAPS.

Register of Mines With Maps.

Asterisks (**) indicate out of print.

**Register of Mines, with Map, Amador County ----
**Register of Mines, with Map, Butte County ----
**Register of Mines, with Map, Calaveras County ----
**Register of Mines, with Map, El Dorado County ----
**Register of Mines, with Map, Inyo County ----
**Register of Mines, with Map, Kern County ----
**Register of Mines, with Map, Lake County ----
**Register of Mines, with Map, Mariposa County ----
**Register of Mines, with Map, Nevada County ----
**Register of Mines, with Map, Placer County ----
**Register of Mines, with Map, Plumas County ----
**Register of Mines, with Map, San Bernardino County ----
**Register of Mines, with Map, San Diego County ----
Register of Mines, with Map, Santa Barbara County (1906) ---- $0.25
**Register of Mines, with Map, Shasta County ----
**Register of Mines, with Map, Sierra County ----
**Register of Mines, with Map, Siskiyou County ----
**Register of Mines, with Map, Trinity County ----
**Register of Mines, with Map, Tuolumne County ----
Register of Mines, with Map, Yuba County (1905) ---- .25
Register of Oil Wells, with Map, Los Angeles City (1906) ---- .35

OTHER MAPS.

Asterisks (**) indicate the publication is out of print.

**Map of California, Showing Mineral Deposits (50 x 60 in.) ----
**Map of Forest Reserves in California ----
**Mineral and Relief Map of California ----
**Map of El Dorado County, Showing Boundaries, National Forests ----
**Map of Madera County, Showing Boundaries, National Forests ----
**Map of Placer County, Showing Boundaries, National Forests ----
**Map of Shasta County, Showing Boundaries, National Forests ----
**Map of Sierra County, Showing Boundaries, National Forests ----
**Map of Siskiyou County, Showing Boundaries, National Forests ----
**Map of Tuolumne County, Showing Boundaries, National Forests ----
**Map of Mother Lode Region ----
**Map of Desert Region of Southern California ----
Map of Minaret District, Madera County ---- .20
Map of Copper Deposits in California ---- .05
**Map of Calaveras County ----
**Map of Plumas County ----
**Map of Trinity County ----
**Map of Tuolumne County ----
Geological Map of Inyo County. Scale 1 inch equals 4 miles ---- .60
Map of California accompanying Bulletin No. 89, showing generalized classification of land with regard to oil possibilities. Map only, without Bulletin ---- .25
**Geological Map of California, 1916. Scale 1 inch equals 12 miles. As accurate and up-to-date as available data will permit as regards topography and geography. Shows railroads, highways, post offices and other towns. First geological map that has been available since 1892, and shows geology of entire state as no other map does. Geological details lithographed in 23 colors. Mounted ----
Topographic Map of Sierra Nevada Gold Belt, showing distribution of auriferous gravels, accompanying Bulletin No. 92 (sold singly). In 4 colors ---- .50

OIL FIELD MAPS.

These maps are revised from time to time as development work advances and ownerships change.

	Price
Map No. 1—Sargent, Santa Clara County	$0.50
Map No. 2—Santa Maria, including Cat Canyon and Los Alamos	.75
Map No. 3—Santa Maria, including Casmalia and Lompoc	.75
Map No. 4—Whittier-Fullerton, including Olinda, Brea Canyon, Puente Hills, East Coyote and Richfield	.75
Map No. 5—Whittier-Fullerton, including Whittier, West Coyote, and Montebello	.75
Map No. 6—Salt Lake, Los Angeles County	.75
Map No. 7—Sunset and San Emido and Kern County	.75
Map No. 8—South Midway and Buena Vista Hills, Kern County	.75
Map No. 9—North Midway and McKittrick, Kern County	.75
Map No. 10—Belridge and McKittrick, Kern County	.75
Map No. 11—Lost Hills and North Belridge, Kern County	.75
Map No. 12—Devils Den, Kern County	.75
Map No. 13—Kern River, Kern County	.75
Map No. 14—Coalinga, Fresno County	1.00
Map No. 15—Elk Hills, Kern County	.75
Map No. 16—Ventura-Ojai, Ventura County	.75
Map No. 17—Santa Paula-Sespe Oil Fields, Ventura County	.75
Map No. 18—Piru-Simi-Newhall Oil Fields	.75
Map No. 19—Arroyo Grande, San Luis Obispo County	.75
Map No. 20—Long Beach Oil Field	1.25
Map No. 21—Portion of District 4, Showing Boundaries of Oil Fields, Kern and Kings counties	.75
Map No. 22—Portion of District 3, Showing Oil Fields, Santa Barbara County	.75
Map No. 23—Portion of District 2, Showing Boundaries of Oil Fields, Ventura County	.75
Map No. 24—Portion of District 1, Showing Boundaries of Oil Fields, Los Angeles and Orange counties	.75
Map No. 26—Huntington Beach Oil Field	.75
Map No. 27—Santa Fe Springs Oil Field	.75
Map No. 28—Torrance, Los Angeles County	.75
Map No. 29—Dominguez, Los Angeles County	.75
Map No. 30—Rosecrans, Los Angeles County	.75
Map No. 31—Inglewood, Los Angeles County	.75
Map No. 32—Seal Beach, Los Angeles and Orange Counties	.75

DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the state may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

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THE STATE MINING BUREAU

CORDIALLY INVITES YOU TO VISIT
ITS VARIOUS DEPARTMENTS MAINTAINED
FOR THE PURPOSE OF FURTHERING
THE DEVELOPMENT OF THE

MINERAL RESOURCES OF CALIFORNIA

At the service of the public are the scientific reference library and reading room, the general information bureau, the laboratory for the free determination of mineral samples found in the state, and the largest museum of mineral specimens on the Pacific Coast. The time and attention of the State Mineralogist, as well as that of his technical staff, are also at your disposal.

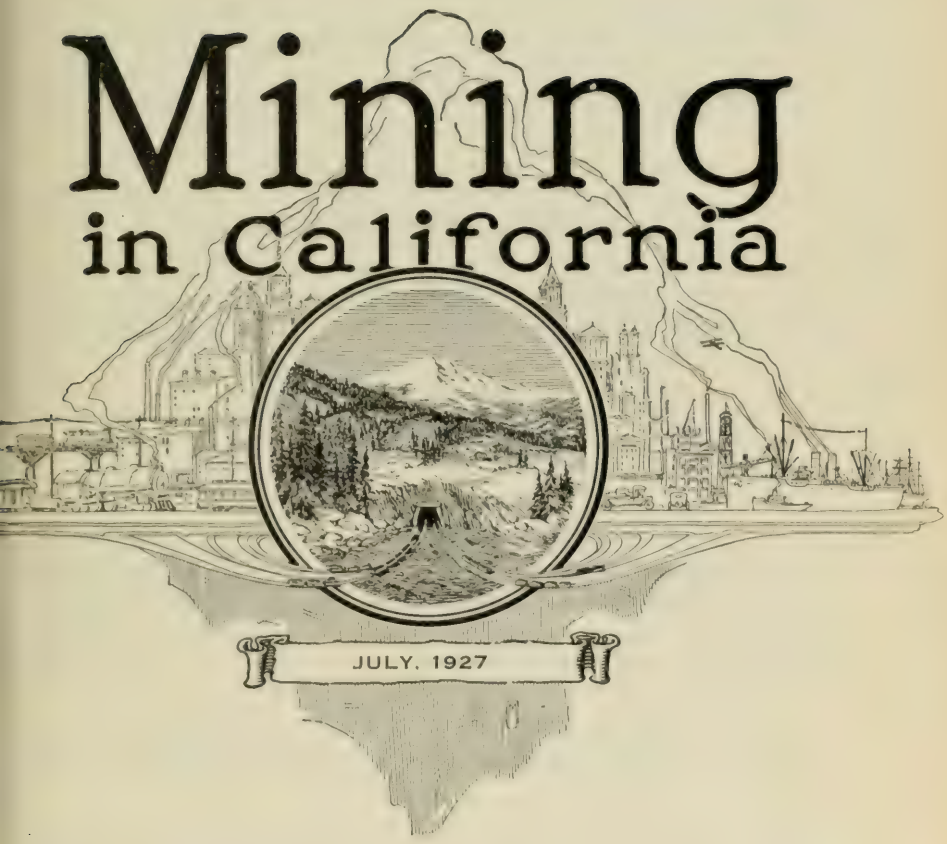
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State Mineralogist.

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Branch Offices: New Orpheum Building, Los Angeles; Chamber of Commerce Building (mail address, P. O. Box 1208), Sacramento; Bank of Italy Building, Bakersfield; Taft, Coalinga, Santa Maria, and Santa Paula.

Mining in California



JULY, 1927

PUBLISHED QUARTERLY

CALIFORNIA STATE
MINING BUREAU

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SAN FRANCISCO

CALIFORNIA STATE MINING BUREAU

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R. D. Bush, State Oil and Gas Supervisor - - - - - - San Francisco

Note.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the State Mining Bureau, entitled 'Summary of Operations, California Oil Fields.'

CALIFORNIA STATE MINING BUREAU
FERRY BUILDING, SAN FRANCISCO
LLOYD L. ROOT — State Mineralogist
Vol. 23 — JULY, 1927 — No. 3

CHAPTER OF

REPORT XXIII OF THE STATE MINERALOGIST

COVERING

MINING IN CALIFORNIA

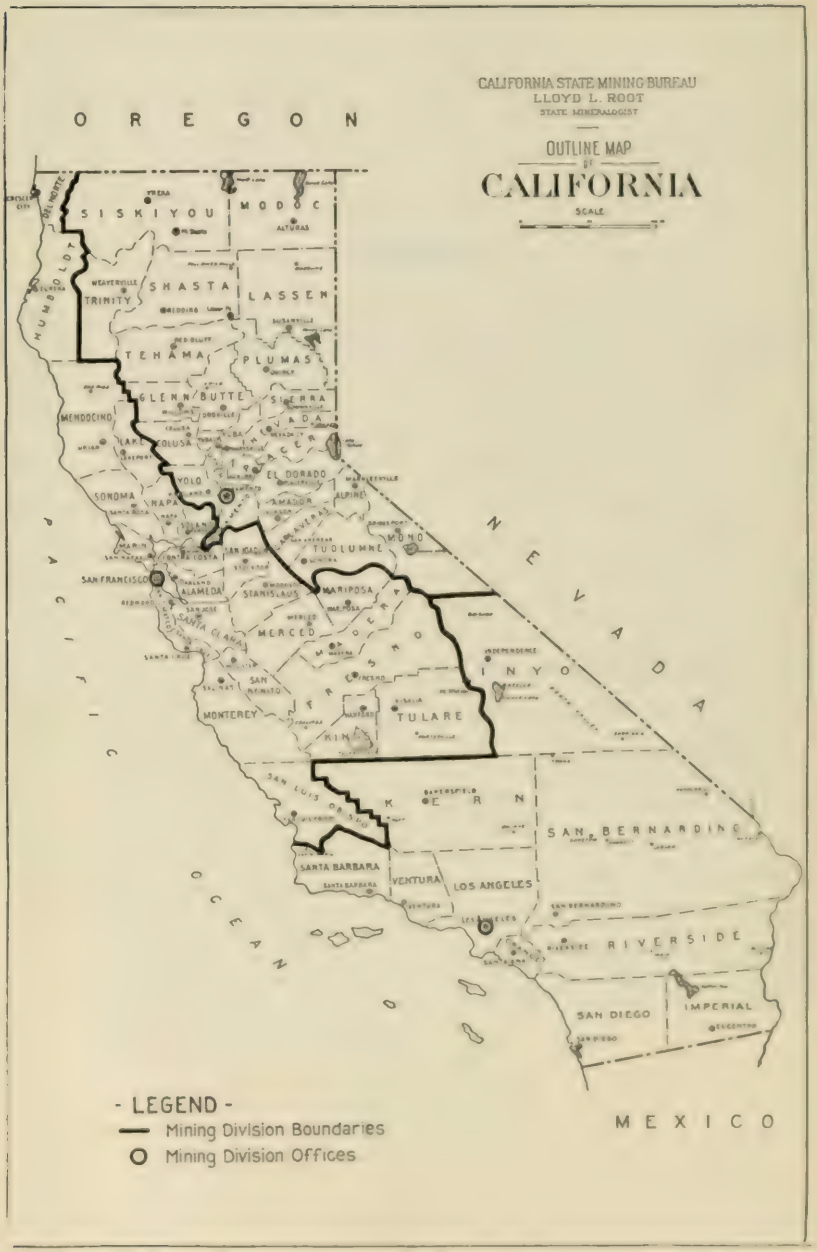
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ACTIVITIES OF THE STATE MINING BUREAU

CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1927

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CALIFORNIA STATE MINING BUREAU
LLOYD L. ROOT
STATE MINERALOGIST
OUTLINE MAP
OF
CALIFORNIA
SCALE
OREGON
NEVADA
PACIFIC OCEAN
MEXICO
SISKIYOU
MODOC
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
GLENN
BUTTE
SIERRA
MENDOCINO
LAKE
COLUSA
YUBA
NEVADA
PLACER
EL DORADO
YOLO
SONOMA
NAPA
AMADOR
ALPINE
SOLANO
MARIN
SAN FRANCISCO
CONTRA COSTA
ALAMEDA
TUOLUMNE
MONO
STANISLAUS
MARIPOSA
SANTA CLARA
MERCED
MADERA
INYO
SAN BENITO
MONTEREY
FRESNO
TULARE
KINGS
KERN
SAN LUIS OBISPO
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
RIVERSIDE
SAN DIEGO
IMPERIAL
- LEGEND -
Mining Division Boundaries
Mining Division Offices

PREFACE.

The State Mining Bureau is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing, this was changed to quarterly publication beginning in September, 1923.

For the same reason, beginning with the January, 1924, issue, it has been necessary to charge a subscription price of $1 per calendar year, payable in advance; single copies, 25 cents apiece. 'Mining in California' will continue to be sent without charge to our exchange list, including schools and public libraries, as are also other publications of the State Mining Bureau.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the Bureau will not discontinue its practice of issuing from time to time technical reports on special subjects. A list of such reports now available is appended hereto, and the names of new bulletins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Mining Bureau is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.

DISTRICT REPORTS OF MINING ENGINEERS.

In 1919–1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively. This move brought the Bureau into closer personal contact with operators, and it has many advantages over former methods of conducting field work. In 1923 the Redding and Auburn field offices were consolidated and moved to Sacramento.

The boundaries of each district were adjusted and the counties now included in each of the three divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

New County Reports.

The series of separate reports on the mines and mineral resources of the different counties, that together comprise the State Mineralogist's Reports XIV to XVII, inclusive, in the case of many of the counties have become exhausted. Those still in stock are in need of revision. It was deemed advisable, therefore, beginning with the January, 1925, issue of 'Mining in California,' to make the district engineers' reports in the form of a complete general report on the mines and mineral resources in one or more of the counties in each district.

This program will be followed as near as possible in succeeding numbers of the quarterly until each county in the state has been covered.

SACRAMENTO FIELD DIVISION.

C. A. Logan, Mining Engineer.

PLACER COUNTY.

Geography.

Placer County extends from the Sacramento Valley on the west for a distance of 80 miles to the Nevada state line on the eastern slope of the Sierra Nevada, including the larger part of Lake Tahoe. The total area is 1395 square miles. The elevation increases gradually from near sea level on the west to mountain peaks 8000 to 9000 feet high along the summit of the range on the east, then descends to 6225 feet along Lake Tahoe. There is a corresponding variation in climatic conditions. The western part of the county below an elevation of 2500 feet supports most of its industries and nearly all of the population of about 20,000. In this region snow seldom falls below 2000 feet elevation and never

lies on the ground below that elevation. The county seat, Auburn, is at an elevation of 1360 feet, and the district from there westward through Newcastle, Penryn, Loomis and Rocklin is the most important deciduous fruit producing area in the state, Newcastle being the leading shipping point. The soil is mainly decomposed granite and granodiorite on the west and amphibolite schist and diabase near Auburn and to the east, until the granodiorite of the high mountains is reached.

The Ogden route of the Southern Pacific system traverses the county from the Sacramento line to the summit of the Sierra Nevada, passing through the principal towns, and the Oregon branch of the same railroad, leaving the main line at Roseville, passes northward through Lincoln, serving the farming and clay-working industries there. Two state highways run about parallel to the two lines of railroad, one eastward from Sacramento over the mountains, and the other northward from Roseville along the east side of Sacramento Valley. A third state highway runs north from Auburn to Grass Valley and Nevada City, in Nevada County.

Taking its name from the Spanish, because of the richness of its surface gold placers, the county showed a great diversity of mineral resources at an early date, and was distinctly a mining county until about 1890, when fruit raising began on a large scale for eastern shipment. Lumbering and the summer grazing of cattle in the higher mountains have been less important industries.

Mineral Resources.

Gold has been the principal mineral product, but there is no exact record of the output prior to 1880 except for some individual mines. An estimated total of $70,000,000 to date is probably reasonable; of this total, about $35,500,000 is known to have been produced since 1880, when the keeping of production statistics began. Not to exceed $5,000,000 of the total came from quartz mines, so it is seen that the county was aptly named.

Granite production began at Penryn and Rocklin as soon as the Central Pacific Railroad reached these points (about 1864) to furnish an outlet. Several hundred men were employed at the quarries at these two towns until about 1890, when labor strikes wrecked the industry there. Small operations continue at Rocklin.

The clay working business began at Lincoln 51 years ago and has grown steadily until at present several hundred men are employed, and it is the most important branch of the mineral industry in the county.

A fine grade of charcoal pig iron was produced from local ore treated in blast furnaces near Clipper Gap during the eighties. Copper has been produced from mines of the foothill copper belt along the western side of the county. Chromite was mined and shipped between 1916 and 1920, principally from the Forest Hill divide. Small tonnages of asbestos, manganese ore, magnesite, mineral paint, soapstone and quartz, and considerable limestone and miscellaneous stone, have been shipped. Platinum group metals have been recovered as a by-product in placer gold mines, especially in the present channel of American River. Low-grade lignite occurs near Lincoln, associated with the Tertiary clay beds, and was mined over 50 years ago for use in making gas in Sacramento.

Year	Gold, value	Silver, value	Copper		Brick		Pottery clay†		Lime and limestone		Miscellaneous stone[1], value	Miscellaneous and unapportioned		
			Pounds	Value	M.	Value	Tons	Value		Amount		Amount	Value	Substance
1880	$838,133	$610												
1881	850,000	6,500												
1882	800,000													
1883	810,000													
1884	887,320	5												
1885	906,301													
1886	1,071,663	1,397												
1887	855,510	556												
1888	850,000	1,000												
1889	1,245,491	1,975												
1890	1,003,602	1,045												
1891	998,495	5,921												
1892	1,159,080	2,120												
1893	1,351,250	616												
1894	1,851,215	664					22,000	$27,500			$67,200			
1895	1,590,035	5,273					15,000	15,000			56,620	25 tons	$1,000	Asbestos.
1896	1,674,844	6,690					10,000	10,000			44,216			
1897	1,524,941	6,784					7,500	7,500			39,412			
1898	1,488,022	5,670					12,000	12,000			29,833			
1899	1,160,081	1,206					15,000	15,000			61,525			
1900	986,155	12,058					15,000	15,000			115,669			
1901	900,745	4,828	11,200	$1,764			15,000	15,000			102,847			
1902	843,366	3,341	3,200	368			15,000	15,000			156,402			
1903	570,571	1,116	4,000	520			15,000	15,000	[2]1,500	$9,000	198,530		280	Platinum.
1904	778,355	9,320	600,000	76,500			16,100	16,100	[3]4,000	4,000	123,448		1,908	Quartz.
1905	597,793	8,041	367,250	57,291			20,000	10,000	[2]15,533	8,737	116,746	2 ozs.	375	Platinum
1906	[4]	[4]	200,000	38,600			20,000	15,000	[2]11,699	11,950	71,130	0.66 ozs.	36	Platinum.
1907	482,772	3,338					20,000	20,000	[2]11,430	11,430	118,722	50 tons	12	Platinum.
1908	358,096	2,194			13,000	$46,300	13,000	11,500	[3]38,869	79,768	178,460	70 tons	2,500	Asbestos.
1909	281,372	1,492			2,083	52,300	45,300	35,250	[2]1,727	1,710	203,783	50 tons	3,500	Asbestos.
1910	257,191	1,157			600	23,438	44,000	27,000	[2]24,322	25,864	242,773		5,000	Asbestos.
1911	251,298	2,585	118,024	14,828	700	18,000	43,120	29,200	[2]10,000	12,100	218,951	60 tons	862,362	Unapportioned, 1901-1902.
1912	307,383	4,791	78,170	12,898	900	21,250	56,000	41,300	[3]222,595	200,000	231,415	200 tons	6,000	Asbestos.
1913	220,785	2,972	429	67	1,900	40,000	63,600	47,200			205,749	125 tons	20,000	Asbestos.
1914	600,000	4,500	453	60	2,000	40,000	63,700	49,000	[3]202,575	202,575	203,593	300 tons	500	Asbestos.
1915	414,310	24,543	[4]		2,000	40,000	49,126	37,536	[3]1,236	2,432	98,187	90 tons	3,300	Magnesite.
1916	428,400	24,928	1,437,441	353,610	2,540	79,000	29,018	36,230			17,026	50 tons	584	Mineral paint.
1917	538,686	13,885	710,601	193,994	[4]		44,097	44,097			10,727	1,000 tons	500	Magnesite.
1918	230,100	22,432	837,527	206,869	and tile	81,408	29,348	29,348			4,266	805 lbs.	2,000	Glass sand.
1919	170,609	3,141			[4]		[4]				4,330	2,000 tons	35	Lead.
1920	151,058	2,178			and tile	149,924	65,560	76,500			6,688	385 lbs.	4,000	Quartz.
1921	132,468	1,068			and tile	144,508	76,665	95,930			21,490	711 lbs.	15	Lead.
1922	119,673	952			and tile	118,797	79,531	111,166			24,430		33	Lead.
1923	75,732	207					82,919	143,097			139,820		346,810	Asbestos and copper.
1924	108,757	534			and tile	186,053	97,670	146,508			15,573	744 tons	11,956	Chromite.
1925	121,785	620			and tile	147,981	102,598	138,813			117,990		80,931	Granite.
1926	82,921	346			and tile	159,591	104,259	147,241			81,814		10,548	Lead, limestone, magnesite.
												4,287 tons	105,384	Chromite.
													30,392	Granite.
													92,624	Asbestos, brick, platinum, tile, gems, magnesite.
												4,963 tons	276,765	Chromite.
													30,882	Granite.
													21,360	Manganese and silica.
												1,018 tons	24,000	Chromite.
													98,513	Clay and clay products.
													36,233	Granite.
													1,055	Other minerals.
												300 tons	7,985	Chromite.
													212,625	Granite.
													5,825	Other minerals.
													48,328	Granite.
													5,278	Chromite, mineral paint, silica.
													12,980	Granite.
												2,000 tons	5,500	Silica.
													12,477	Other minerals[5].
													5,146	Granite.
												3,656 tons	10,040	Silica (quartz).
													120,372	Other minerals.[6]
													19,155	Granite.
													15,000	Other minerals.[7]
													14,929	Granite.
													8,295	Other minerals.[8]
												6092 cu. ft.	11,969	Granite.
													6,000	Other minerals.
Totals	$32,936,093	$204,689	4,368,895	$957,369		$1,339,550	1,307,102	$1,455,016		$569,586	$3,329,383		$2,603,957	

[1] Includes granite (prior to 1916), crushed rock, rubble, rip-rap, paving blocks, sand, gravel.
[2] Barrels of lime.
[3] Tons of limestone.
[4] See under 'Unapportioned.'
[5] Includes chromite, mineral paint, mineral water.
[6] Includes brick, building tile, chromite.
[7] Includes mineral paint, mineral water, silica (quartz).
[8] Includes chromite, copper, silica (quartz).
† Figures for value of clay are for crude clay only. The annual value of clay products is several times greater, but is omitted because there is only one factory. Production began in 1875.

Power and Water.

The quartz mining district near Ophir and Auburn, the foothill copper belt, the Lincoln clay pits and properties near the railroads have the advantage of electric power. Some mines along the Forest Hill divide had their own hydro-electric power plants, but most of them in this region and in the more remote mountainous districts must rely on gasoline engines. There are no streams of importance on the extensive lava plateaus under which the buried gravel channels occur. Drainage is confined to the forks of American River, which flow in canyons 1000 to 2500 feet below the tops of the ridges, and to steep tributaries which have likewise cut deep canyons far below the general level of the surface. Water rights for the most part have been appropriated by large companies, such as the Pacific Gas and Electric Company, which controls the distribution of electric power and water for irrigation, so far as developed, and at least two other large power projects are now being planned to use water from the American River.

Timber.

There is an abundant timber supply in the eastern part of the county, particularly along the Forest Hill and Iowa Hill divides and in the higher mountainous country extending from Forest Hill east and northeast to Lake Tahoe. This country has no railroad facilities and the only timber cut in most of the area has been that used for mining purposes. The entire section beginning a few miles east of Colfax, thence east and north to the county line, and comprising much more than half of the county, is within Tahoe National Forest. Forest fires along the flanks of the Forest Hill divide have destroyed considerable timber in recent years.

Transportation.

Besides the two lines of railroad mentioned, and the state highway system, there is a good system of county roads. The mines of the Forest Hill, Iowa Hill, Duncan Canyon and Last Chance districts are reached by roads from Colfax and Auburn, the last two named being between 50 and 60 miles from the county seat, and not accessible by auto after the first heavy snow.

ASBESTOS.

Both chrysotile and slip fiber amphibole asbestos occur in the county. None of the prospects are being worked at present. Both varieties occur in serpentine or along its contact with other rocks.

Blue Wing and Dewey Claims are in Sec. 28 and Sec. 33, respectively, in T. 15 N., R. 10 E., one-fourth mile east of Iowa Hill. They contain a ledge of white, slip-fiber tremolite asbestos, which shows in the bedrock of the old hydraulic mine workings. It is at the contact of serpentine and the Cape Horn slate, and is reported to be from six to fifteen feet wide. The same ledge occurs on the *Washington* and *Clear Fiber* claims and is said to have been found in the old *Morning Star* drift mine. According to Waring, fibers eight inches long were of good quality.

Bibl: Cal. State Min. Bur. R. XV, pp. 321–322.

Driscoll & Michelson claims are in Sec. 1, T. 15 N., R. 10 E., a mile and a half southeast of Towle in the steep canyon of North Fork of American River. Only a meager prospect of slip-fiber asbestos in serpentine was observed on these claims.

Morgan Asbestos claims are a short distance east of the Driscoll & Michelson claims in the canyon of American River, a mile and a half southeast of Towle. These claims have produced some good quality, long-fiber asbestos, silky in texture and strong. Seventy tons are reported to have been shipped, but no work has been done lately.

Dan Sullivan, Alta, and associates have found a prospect of short cross-fiber chrysotile asbestos in serpentine about four miles north of Towle and on the south side of Bear River. Practically no work has been done on it, and as the surface is covered by loose rock, the extent of the deposit is unknown. The percentage of fiber in samples is high.

Wolf & Levy claims adjoin the Driscoll & Michelson claims and show similar meager prospects.

Prospects of chrysotile asbestos occur southwest of Cisco in the vicinity of Monumental Hill.

CHROMITE.

Placer County was an important producer of chromite during the World War, but in recent years only a small amount of high-grade ore has been marketed from a single property, operated by *Dan Sullivan*, Alta, close by the railroad near Gorge. The most productive district was that near the old Sugar Pine Mill on the divide east of Forest Hill and formerly the Damascus Mining District.

The table below gives the location of most of the properties active between 1917–1919, but since idle, with the one exception noted above. They were described in our Bulletin 76.

Table of Chromite Properties in Placer County.

Name	Location	Distance from R. R. point
Bunker	Sec. 21, T. 14 N., R. 11 E.	21 miles to Colfax
DeKruse	S½ Sec. 30, T. 15 N., R. 11 E.	12 miles to Colfax*
Fiddlers Green	NE¼ Sec. 29, T. 13 N., R. 9 E.	14 miles to Auburn
Garrison	1 mile SE. of Foresthill	16 miles to Colfax
Gas Canyon	Sec. 13, T. 13 N., R. 9 E.	13 miles to Auburn
Green	SE¼ Sec. 12, T. 13 N., R. 9 E.	13 miles to Auburn
Linder & Hodges	Sec. 25, T. 16 N., R. 10 E.	2 miles to Alta
I. H. Parker	6 miles NE. of Auburn	6 miles to Auburn
Scheirmeier	At Michigan Bluff	20 miles to Colfax
Sugar Pine	Secs. 29, 31, T. 15 N., R. 11 E.	14 miles to Colfax*
Sullivan	NE¼ Sec. 19, T. 16 N., R. 11 E.	Adjacent to R. R. track; Gorge
Turner & Geisendorfer	NE¼ Sec. 30, T. 15 N., R. 11 E.	14 miles to Colfax*
Williamson & Beck	Secs. 19, 30, T. 15 N., R. 11 E.	13 miles to Colfax*

*These distances are by way of new Iowa Hill-Colfax road, now being built.

CLAY.

The clay industry is the most important branch of mining in Placer County, employing at present about 550 men at and near Lincoln, where all the work is carried on. The total annual production of crude clay is between 125,000 and 150,000 tons. Operations began there in 1875. Deposits of Ione age, which furnish the clay, occur at and near Lincoln, between Lincoln and Rocklin, and at Rocklin, but only those

first named have been developed. Taking their geologic name from the town in Amador County where similar beds exist, the Placer County deposits differ from those near Ione in some respects. They contain in places less silica sand, more alumina, and are more plastic, and some users mix the two in order to obtain the results desired.

After the clay was deposited, the stream channels and side valleys leading down from the foothills of the Sierra Nevada were filled by deposits of andesite boulders and mud. Subsequent erosion has removed the higher, unprotected land, leaving the best of the clay under the covering of andesite. There is an overburden of 12 to 22 feet, including 8 to 12 feet of the breccia and the balance impure sand and clay. Below this occur successive beds of different colored clay, including white, red, yellow and blue. On one property, lignite coal beds are known to lie at depths of 46 to 70 feet below the surface, and black clay, probably colored by lignitic material, was encountered elsewhere.



PHOTO NO. 1.

Clay storage building and grinding plant of Clay Corporation of California near Lincoln.

Clay Corporation of California is a subsidiary of Stockton Fire Brick Company, which has a plant at Stockton and an office in the Rialto Building, San Francisco. O. M. Tupper is superintendent at the Lincoln property.

This property, two miles by road northwest of Lincoln, near the railroad, was opened to insure a steady supply of clay of uniformly high quality. There are more than 1,000,000 tons of clay available, according to preliminary estimates, in the 160 acres of clay land.

The overburden of andesite breccia and waste sand and clay is stripped with a P. & H. ¾-cubic yard gasoline steam shovel and dumped just beyond the pit on land not considered as carrying enough clay to mine. A Plymouth 8-ton gasoline locomotive and nine rocker dump cars are used for waste and clay transportation. After enough ground is stripped for a season's run, clay is mined with the shovel, and hauled in trains of six cars to the storage building. So far a depth of 23 to 25 feet has been mined, including 15 feet of refractory

white and light-colored clay. This is underlain, in order, by 8 to 10 feet of red or pink clay, 12 feet of yellow clay, 20 feet of white and yellow mixed, and an indefinite depth, possibly 60 feet, of a good quality blue clay. Work is not planned below the red clay. From the rail trestle, clay is dumped to a 21- by 42-inch single roll crusher, operated by 40-h.p. electric motor, which crushes to 3-inch size, and from this the clay passes to a belt conveyor 366 feet long which elevates it to the top of the storage building, in which it is distributed uniformly, and is air dried. The storage building, 300 feet long by 70 feet wide, has a storage capacity of 15,000 tons. There is a concrete tunnel under it, fitted with gates and a belt conveyor, onto which clay is drawn for conveying to the grinding plant. This conveyor delivers to a second one, having an inclined belt which transports clay to the three storage bins above the grinding unit.

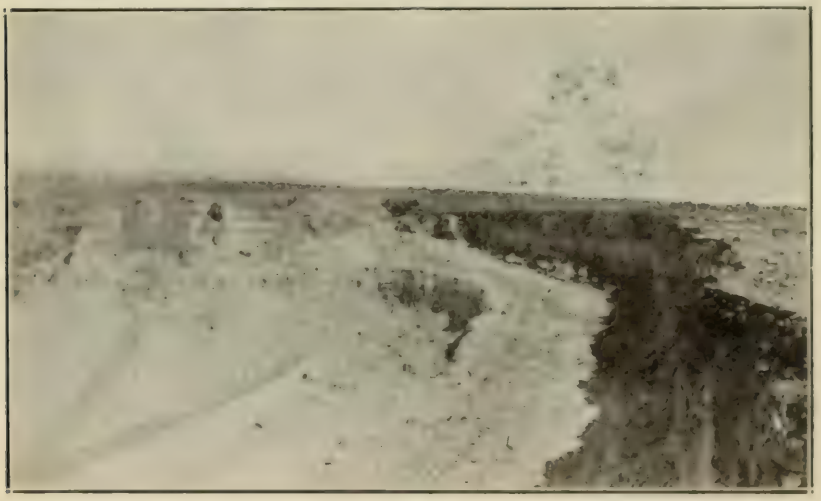


PHOTO NO. 2.

Clay pit recently opened by Clay Corporation of California near Lincoln.

Clay is ground in a 5-roller Raymond mill giving a product of which 98% passes 100-mesh. A blower raises ground clay through a long pipe to the top of the mill building, from which it is distributed to three 50-ton storage bins. These are fitted with spouts for filling paper bags in which shipment is made.

The maximum mining capacity is estimated to be over 500 tons per 8-hour shift and the mill capacity up to about 50 tons a shift. The large storage capacity had to be provided to permit drying and because the pit is only worked in the dry season, six to seven months of the year. The plant is supplied with spur tracks from the Southern Pacific's Oregon line, 1600 feet distant. Clay is supplied to customers as well as for the company's own use. The storage and grinding plants are operated by electricity entirely. A detailed description of the enterprise by C. N. Schuette* was published in *Engineering and Mining Journal-*

*Mining Engineer, San Francisco, Calif.

Press, June 12, 1926. The plant was completed and began production late in 1925.

James Gavin, Forest Hill, has submitted for analysis at the city filtration plant, Sacramento, samples of decomposed rock, apparently originally a shale, reported to be from the bedrock of a gravel mine near Forest Hill. Partial analysis of two samples showed 36.72% Al_2O_3 and FeO in one case, and 48.87% Al_2O_3 and FeO in the other, with only a small amount of iron in the latter. The remaining parts of both samples were insoluble, and probably were chiefly silica. The deposit is 18 or 19 miles by road from Colfax, the nearest railroad station.

Gladding, McBean and Company operate at Lincoln the largest pottery in northern California. This plant was established in 1875 with one kiln, using wood fuel. Only recently the sons of the founders have turned over their official duties to others, the firm name having been bestowed upon a great consolidation of western clay products establishments (including manufacturing plants at Lincoln, Glendale, Los Angeles, Santa Monica, and Alberhill, as well as three plants in the state of Washington, one in Oregon and 21 separate clay mines and parcels of clay land). At Lincoln the company has about 500 acres of land, employs 500 men and produces annually about 50,000 tons of clay products. Charles Gladding is superintendent of the Lincoln plant.

The clay beds are covered by 6 to 12 feet of andesite breccia, containing some large, angular blocks. The main pit has been worked in five different benches. Sand and fine gravel, in places as much as 15 feet thick, furnished some red-burning clay. This lies above the fire-clay beds. Three benches in the clay are each about 15 feet high. Stripping and mining is done with steam shovels. Clay is hauled in side-dump cars to a storage shed 450 feet long by 75 feet wide. The following are analyses of the clay, furnished by the company:

	Fire clay	Red clay
Silica	50.38	56.47
Alumina	32.11	21.90
Ferric oxide	2.99	7.70
Titanium	.38	----
Manganese	.56	----
Calcium	1.15	1.15
Magnesium	1.07	1.26
Alkalies	----	0.27
Ignition loss	11.29	11.25
Moisture	----	----
Total	99.93	100.00

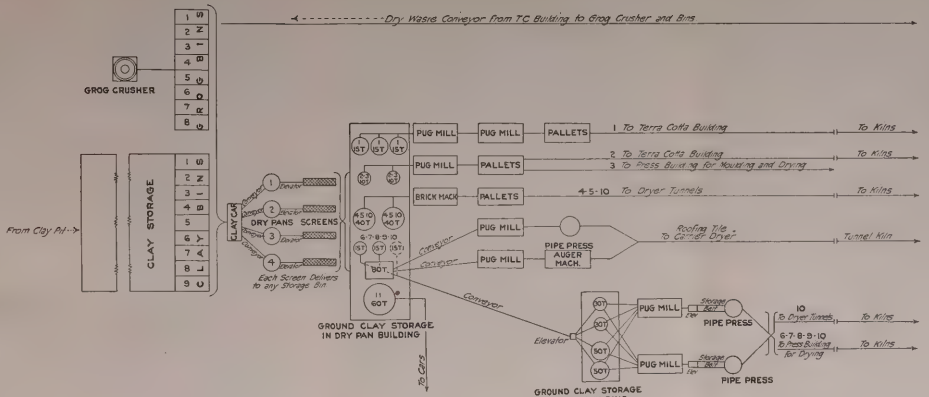
Color: Buff and red burning.
Shrinkage: Averages about 15%.
Fusibility: Fire clay, 3286° F.. Red clay, cone 10, 2426° F.
Absorption: 3% to 10%.

The process of grinding, screening and preparing the clay in the various shapes for the kilns is indicated on the accompanying flow sheet. A feature of interest in the grinding process is the automatic control of the feed to one of the dry pans. The conveyor feeding this dry pan is operated by a small electric motor, connected to the large motor driving the dry pan. When the large motor is under full load, with the dry pan working at capacity, the motor uses so much electricity that



Photo No. 3.

Plant of Gladding, McBean and Company at Lincoln.



GROG BINS

Reference Number	KIND OF GROG	Capacity in Tons
1	Sewer Pipe	30
2	Chimney Pipe	30
3	Terra Cotta	30
4	Fire Tile	30
5	Fire Clay	30
6	Cinder Sand	30
7	Grog from TC Mill	30
8	Coarse Rock	30
9		30
	Total	270

CLAY BINS

Reference Number	KIND OF CLAY	Capacity in Tons
1	(Details not yet Completed)	30
2		30
3		30
4		30
5		30
6		30
7		30
8		30
9		30
	Total	270

GROUND CLAY STORAGE

Reference Number	MANUFACTURED PRODUCT	In Dry Pan Building: Number of Bins	In Dry Pan Building: Capacity in Tons	In Press Building: Number of Bins	In Press Building: Capacity in Tons
1	Terra Cotta	3	15	45	
2	Fire Tile	1	2	10	20
3	Moulding Clay	1		30	
4	Fire Brick	1	2	40	80
5	Fire Brick	1			
6	Super Tile	1			
7	Roofing Tile	2			
8	Sewer Pipe	1			
9	Chimney Pipe	1	2	15	30
10	Pipe Shipping	1		15	30
11	Ground Clay	1	1	60	60
12	Kitchen Range				
13	Drain Pipe				
14	Conduit Pipe				
	Total		24	315	60

* For Shipping Only — Total Storage 335 Tons

GLADDING Mc BEAN AND CO.

LINCOLN, CAL.

FLOW SHEET

NOT TO SCALE.

Corrected to Aug. 15, 1927.

LELAND S. ROSENER
Consulting Engineer
San Francisco Cal

the small one can not operate, stopping the conveyor until the dry pan can handle more clay. There are 22 round down-draft kilns, ten muffle kilns and a tunnel kiln in use, the latter being 364 feet long, holding 43 cars.

The terra cotta department is the most important, employing one-half or more of the total crew. The products of this department require a great deal of skilled hand labor as well as technical care. Architectural terra cotta made here has gone into the construction of many of the largest buildings put up in recent years on the Pacific coast. Granitex terra cotta, one of the later developments, resembles granite quite closely. The tempered clay-grog mix for these products is aged five or six days under damp burlap in cool rooms.

Other products include conduit pipe, sewer pipe, chimney pipe, fire brick, face brick, fire tile, garden pottery, roofing tile, building blocks, laundry trays, sinks and ornamental terra cotta. This plant was originally established to make sewer pipe, which still remains one of the principal products. The pipe is burned five days at a temperature of 1200° C.

The tunnel kiln was intended primarily to burn roofing tile, but has been tried successfully on sewer pipe and other products. This kiln is said to make a large fuel saving and to give improved working conditions. It has a capacity of 31 tons of roofing tile or 62 tons of brick in 24 hours.

Crude oil is used for fuel and electricity for power, including many storage battery trucks. Besides the local clay, they use loam from Oroville and clay and sand from Ione.

Lincoln Clay Products Company's clay land and plant are about two miles northwest of Lincoln, adjoining the state highway, and have a spur track connecting with the Southern Pacific Railroad. M. J. Dillman, president. Office, Lincoln, California.

The property was opened in 1908 and has been increasing its scale of operations steadily. There are 33 men employed at present, as compared with 12 in 1920.

The clay beds are covered by as much as 22 feet of overburden, which is stripped with a P. & H. gasoline shovel with ½-cubic yard dipper. The upper beds of clay, called No. 1 to No. 6, have a total thickness of 14 feet. These beds are white to light colored and clay from them burns lighter colored than that below, called the No. 7, or reddish clay, which is 12 feet thick; No. 8, a yellow clay, is 8 feet thick and below No. 7. Below No. 8, test pits have been sunk 12 to 14 feet in blue clay said to be of good quality. None of it has been marketed yet. In places on the property brown lignite was encountered at depths of 46 to 70 feet in drill holes.

Clay is mined by hand in benches and hauled from the pit in side dump cars by gasoline locomotives. Five of these locomotives, ranging from three to eight tons capacity, and 60 side-dumping ore cars are used. There are about three miles of narrow-gauge tracks in the pit. A hoist lifts the clay cars to the top of the storage building, where it is weighed and either dumped into gondola cars for immediate shipment or stored for air drying, as desired.

The widespread market supplied is shown by the fact that 46 customers are served. The principal products made from this clay are architectural terra cotta, face and common brick, tile, sewer pipe, building blocks, and firebrick. The Lincoln clay, on account of some variations



PHOTO NO. 4.

A section of the clay pit of Lincoln Clay Products Company near Lincoln.

between it and the lone clay, is often mixed with the latter to give desired shrinkage, freedom from spalling, or other qualities. There was formerly a small production of washed kaolin from an experimental plant at the property. This has been abandoned. Most of the clay is

shipped crude, either directly or after air drying, but a few carloads of ground clay are marketed monthly. The mill is a Williams Hammer mill, operated at 2200 r.p.m. by a 60-h.p. electric motor. The clay is ground through 16-mesh. A 24-inch Sturtevant fan exhausts ground clay into bins on the floor above the mill. This company works its pit throughout the year.

Undeveloped deposits of sandy clay occur from two miles east of Towle to a point west of Dutch Flat along the line of the Southern Pacific railroad. There are similar beds on *Towle Brothers'* property, near Towle station, and on the land of the Zeitler estate, about a mile and a half from Towle on the state highway. It is green when wet, but nearly white when dry. These deposits are rhyolitic sand and ash principally.



PHOTO NO. 5.

Plant and a part of the clay pit, Lincoln Clay Products Company.

COAL (LIGNITE).

Lignite occurs at and near Lincoln, associated with the sand and clay of the Ione (Tertiary) formations. Fifty years ago or more small mining operations were carried on under the townsite and a mile northwest of the town. Caved ground indicates that coal was mined out under an area of several acres. Part of it, at least, was shipped to Sacramento and retorted to furnish gas.

The beds lie nearly flat, but with such a poor roof and floor that considerable timber was required. The mines were closed years ago because of increasing cost of operation and competition of other fuels.

Lincoln Clay Products Company owns land one mile northwest of Lincoln beside the state highway, where drilling has revealed the presence of lignite. The beds are reported to be 7 to 14 feet thick with a pink-clay roof and blue-clay floor. They lie at a depth of from 46 to 70 feet. The logs of the drill holes indicate a large unmined reserve of the

lignite. The mode of occurrence is similiar to that near Ione, the deposits having been made in a chain of shallow marshy lakes or inlets along the shore line.

COPPER.

The recorded production of copper began in this county in 1901. From 1904 to 1906, inclusive, about 1,200,000 pounds were produced, after which a period of idleness ensued until 1911. There was a small output in 1911 and 1912, but it required the stimulus of high war-time prices to bring active operations which resulted in the production of about 3,000,000 pounds of copper between 1916 and 1918, inclusive. There has been no production since. The principal producers were the Dairy Farm Mine near Sheridan and the Valley View, northeast of Lincoln.

The small copper mines and prospects of the county are a part of the foothill copper belt, where carbonate and sulphide ores occur as a rule in amphibolite schist. The ores carried usually several dollars worth of gold a ton in the leached zone near the surface, from which the copper had been removed by descending solutions, leaving an iron-stained gossan. This character of ore was worked in several mines for its gold content, until the sulphide ore was encountered at a depth of 85 to 100 feet. Except for the Dairy Farm and Valley View, a depth of hardly 100 feet has been reached.

Dairy Farm Mine is in the SE¼, Sec. 27, T. 14 N., R. 6 E., eight miles northeast of Sheridan. It was first worked for gold, which occurred with some silver in the oxidized gossan to a depth of 85 feet. Below there, a low-grade copper sulphide orebody carrying some gold was exploited. The ore is reported to have been in the form of lenses in amphibolite schist and to have averaged 3% to 3¼% copper, with considerable pyrite. The mine was the principal copper producer of the county, having been worked by Dairy Farm Mining Company between 1900 and 1907 and during the war period and up to 1919 by Van Trent Mining Company as lessee. It was operated through an inclined shaft 590 feet deep with about 1000 feet of drifts and other workings on each level. After being abandoned and reported worked out, a large tonnage of low-grade stored near the railroad was shipped. During the later mining operations 350 tons of ore was mined daily, and, after sorting, the better grade was hauled by narrow gauge railroad to the Southern Pacific northwest of Sheridan for shipment to Richmond and finally to Oregon for smelting. The cost of placing ore on the cars at Sheridan was said to be about $1.70 a ton.

Bibl: Cal. State Min. Bur. Bull. 50, p. 208; R. XV, p. 327.

Valley View Mine is in SE¼, Sec. 12, and NE¼, Sec. 24, T. 13 N., R. 6 E., six miles by road northeast of Lincoln. Judge J. B. Landis and Ed. Gaylord, Auburn, are the owners. Under the name of Whiskey Hill or Harpending Mine, this property was worked for gold in the sixties and had a 40-stamp mill in 1867 for crushing the oxidized gossan ore, in which gold occurred free with some metallic silver. At that time, copper in the ore was alluded to only as a subordinate metal. The oxidized shallow ore was a secondary enrichment, the iron and copper

having been leached out, leaving a soft, light and easily milled rock from which gold was cheaply extracted.

Copper sulphide and pyrite ore was found at a depth of 85 to 100 feet. There are three shafts on the property, the south shaft 130 feet deep, one on the southeast 180 feet deep, and that on the northwest end of the ore zone, 280 feet deep. At a depth of 150 feet in the southeast shaft there is a drift reported 125 feet long. From the 280-foot shaft ore was stoped from 120-foot level to the surface, and an open cut also supplied ore. The ore is in part in altered dikes which intrude the amphibolite schist county rock along the line of the dip and strike of the schistosity of the latter. The strike is N. 80° W. and the dip northeast about 72°. Zinc sulphide and pyrite in increasing quantity with lower copper content were encountered in the lower workings.

No figure of the total output is obtainable, but a number of carloads of good ore were shipped in later years. There has been no production since 1918. Samples have lately been tested to determine the feasibility of making separate zinc and copper concentrates by flotation.

The following are other *copper prospects* that have been worked only in a small way:

Name	Location Sec.	Twp.	Range	Principal working
Algol	9	13 N.	7 E.	2 shafts 120′ deep; 200′ drifts
Big Pine	16	12 N.	8 E.	170′ shaft
Davenport	15	12 N.	8 E.	70′ inclined shaft
Elder	4	13 N.	6 E.	25′ shaft
Globe Cons.	8	12 N.	8 E.	250′ inclined shaft
Greenhorn	Junction of Greenhorn-Bear River.			
Nevada	32	14 N.	8 E.	55′ shaft
Thomen	4, 5	13 N.	8 E.	

Bibl: Cal. State Min. Bur. Bull. 50, p. 174; R. XV, pp. 327–330.

GOLD (QUARTZ MINES).

Quartz mining began in the county in the fifties, there being at present on the Pioneer Mining Company's property near Damascus the ruins of an old mill with square stamps, which was one of the earliest in the state. In spite of the immense sum recovered from its placer mines, the quartz mines have never been developed to such depths nor on as important a scale as in the counties north and south.

Beginning with the western part of the county, the most important group of quartz mines so far developed were in the Ophir District, two to four miles west of Auburn. The contact of granodiorite and amphibolite schist strikes west of northwest. Veins occur both in the granodiorite and amphibolite near the contact for several miles. They strike usually a little north of west and dip south. A great number of small 'pocket' veins occur in the amphibolite at Auburn and for several miles northwest of the town. The ore in the Ophir District shows considerable silver. Pyrite and galena are the principal sulphides, but a little zincblende and copper sulphide are seen at times. The greater number of mines at Duncan Hill and Ophir have been typically 'pocket' mines in which very rich ore has been found in bunches or small ore shoots. The occurrence of such ore in the amphibolite appears to have been affected, if not controlled, by the presence of zones in the schist which are richer in pyrite than the ordinary rock. But there have also been several mines which have contained moderate sized

orebodies of milling ore. The more important of these were the *Oro Fina*, *Hathaway*, *Gold Blossom* and *Crater*. The greatest depth reached is about 1000 feet. The veins average about two to three feet in width, but swell and pinch, especially in the amphibolite, as is characteristic with this rock.

The granodiorite intrusive undoubtedly underlies the amphibolite in the vicinity of the contact, so it may be expected that the veins will pass downward from the amphibolite into the granodiorite. Under proper geologic conditions, the veins should continue in the granodiorite. The deepest developments here have been in the granodiorite. All of the deepest work at Grass Valley, Nevada County, has been in granodiorite. None of the quartz mines in the district are active. The Oro Fina was the last operated, and is described as an example.

About a mile east of Penryn is a group of small quartz mines which were active between 1860 and 1885. These are in the granodiorite and produced low and medium grade ore. The deepest work was about 600 feet at the Chicago.

The Mariposa slate of the Mother Lode belt enters the county near Weimar. The Black Oak Mine has been profitably worked there, but development has been limited. There have also been some 'seam diggings,' where free gold occurs in the slate in quartz seams and has been mined by hydraulicking the soft upper oxidized zone, as was done in the nearby Spanish Dry Diggings and Georgia Slide districts in El Dorado County.

The most important quartz gold producer in the county was the Rising Sun, a mile and a half west of Colfax. A long tunnel is being run there to give drainage preparatory to new prospecting.

From the Middle Fork of American River, three miles south of Bath, there extends northward with interruptions a belt of peridotite and serpentine derived from it. West of it lies a belt of amphibolite schist. The two rocks may be traced almost due north to Alleghany and Downieville, Sierra County. Along their contact, and in the amphibolite schist near it, pocket mines have been opened in a small way with profit. Probably this pocket belt, of which a large part was undoubtedly covered by later andesite flows, enriched the gravel of the ancient streams which flowed across it. The Garbe and de Maria Mine in Ladies Canyon has produced many thousands of dollars worth of beautifully crystallized gold and is still operated. The Four Aces Mine is also active in Volcano Canyon. The serpentine contains bodies of talc schist, mariposite and barite. Finely divided gold occurs in places in the talc, but is difficult to recover.

Four miles southeast of Towle in the large area of Carboniferous rocks locally called the Blue Canyon formation, are found many prominent veins of quartz. Most of these have been prospected and many have been productive. The Blue Canyon formation is composed principally of black clay slate and quartzitic sandstone. Igneous dikes are often to be seen accompanying the veins. The Pioneer Mine on the Pioneer and Lynn veins, has been the largest developed. The Black Hawk and American Eagle mines are active now on a small scale. The Pioneer operations are described herein. The American Bar, and the Herman, Black Canyon and Canada Hill mines, farther east in the high mountains, are in the Blue Canyon formation, which is the bedrock

formation of most of the higher eastern part of the county. The first and last named are active.

American Eagle Prospect is in the canyon of North Fork of American River, a mile and a half upstream from the mouth of Humbug Creek, and reached by a trail from Towle or from the Pioneer Mine. There is a quartz vein four feet wide where opened in prospecting five years ago. The footwall is black slate and hanging wall gray schist. A little work has been done at intervals by a stock company, under different names. A 10-stamp Straub mill has lately been installed. A total of about 240 feet of underground work is reported.

Big Ben Mining Company was not successful in developing free-milling ore on its property five miles north of Lincoln. A large sum was raised from the sale of stock and considerable prospecting done to a depth of 360 feet. The prospect is in amphibolite schist near the granodiorite contact.

Black Hawk Mine is on the North Fork of American River, four miles southeast of Towle by trail. A. B. Chase and others of Roseville have moved 10 stamps of the old Southern Cross mill to the claims and were erecting them in July, 1927, preparatory to crushing ore. The property was first developed years ago, and Chase believes some of the quartz then broken will pay to mill and that there are good prospects in the adit workings.

Canada Hill Mines comprise two groups of claims, the Beauty Group of ten claims and Nob Hill Group of seven claims, each covering 4500 feet on the strike. They are at Canada Hill, 44 miles from Auburn via Forest Hill, and the elevation is 6225 feet at the Beauty shaft. A 30-ft. shaft and an upper adit 200 feet long gave good prospects in a quartz vein one and one-half to three feet wide and striking northeast. In 1919 and 1920, Metals Exploration Company prospected it under lease and option. A lower adit was run 800 feet, of which 600 feet was a crosscut. They gave up their option in 1920. Since then Snyder has resumed work and some ore is reported being crushed in a 10-stamp mill during the present year. The Nob Hill claims have been prospected by adits. The veins are of fair size and assayed well at the surface.

Centennial Mine on Duncan Hill, two miles southwest of Auburn, is an example of a type common in the district. The vein is about 30 inches wide, in amphibolite schist, but pinches down at intervals. It strikes N. 80° W. and dips 70° south. The ore occurred in small rich shoots, from two to fifty feet long, the formation of which appeared to have been influenced by 'iron crossings,' the miners' term for zones rich in pyrite and chalcopyrite in the amphibolite schist. Ore was mined in 11 or 12 shafts, the deepest 180 feet. After this, adits were run from each end of the claim, one 700 feet long and the other 900 feet, connecting a few feet apart vertically at one of the shafts. The plan was to mill the entire vein, but this was unsuccessful. The total production was $150,000 or more. The estimated value of ore in the rich shoots was $8 to $12, but the vein as a whole is low grade. The Booth, Conrad and Crandall are nearby mines which have all made some production, but are all idle. The ore of Duncan Hill contains gold, silver, lead and copper, the sulphides being rich at times.

Chicago Mine was an example of mines in the granodiorite near Penryn. Several small quartz mines were worked between 1860 and 1885 about a mile east of the town. A vein of solid quartz two to three feet wide strikes N. 20° to 30° E. and dips from 70° east to vertical at the Chicago. On the north end it breaks into stringers. A shaft was sunk 500 feet. For the first 200 feet the ore is stated by a former superintendent to have averaged $7 a ton. Ore was mined for a length of 400 feet on the 300-ft. and 400-ft. levels, but ran as low as $4 a ton there. Around 500 feet deep the vein was breaking into stringers. The walls were hard and stood well without timber. All mining was by hand. A 10-stamp mill was operated. The Alabama and Elizabeth were nearby mines worked at the same time. The placer mines along Secret Ravine, which drains this district, were enriched by erosion of these veins.

Four Aces (formerly *Three Queens*) *Mine* is part of a group of 14 claims, said to cover 10,500 feet along a dike of serpentine and its contacts with schists, and extending from the Spanish Mine southeast of Forest Hill to the Middle Fork of American River. A road three miles long from Forest Hill drops 1800 feet in reaching the camp, which is on Volcano Canyon at an elevation of 1360 feet and one mile north of the river.

Some work was done here and about $45,000 was produced a number of years ago by George Wingfield. The pay ore was taken from a small 'pocket' orebody only a few feet underground. The area mapped as peridotite and serpentine contains strips of black, graphitic schist and completely altered rock, evidently igneous dikes originally. The serpentine is also altered to talc and mariposite in places. To the west lies amphibolite schist, and strips of this also occur in the serpentine, the graphitic schist probably also being a phase of it.

A total of 550 feet of underground work had been done here to July, 1927, entering near the level of Volcano Canyon. Of this, 430 feet was drifting. A quartz vein three to four feet wide where stoped, strikes northwest and dips 30° to 40° northeast. It has the black graphitic schist and altered dike on the hanging wall and mariposite on the footwall, in those places where the best ore is reported. Three stopes, the longest being 90 feet, have been opened. High-grade ore occurs in small bunches showing considerable free gold in this vein. This high grade evidently formed along the hanging wall, by repeated opening, and gold was precipitated by graphite and carbonates in the schist. Orebodies will probably be confined to the veins at the contact of amphibolite, black schist or dikes with the serpentine, the last named alone being unfavorable for vein formation. Near the southeast end of the drift, 348 feet from the portal, a floor dips N. 20° W. Gold occurs in the filling of this flat seam. It appears as if such seams might be caused by the slipping of the hillside and the presence of gold in them might be due to secondary, downward enrichment.

About 1000 feet southeast from the face of this drift there is a winze 148 feet deep on the Scorpion claim. To the northwest, 1250 feet away, 120 feet of workings were run along the contact and good assays reported.

The equipment includes a 5-stamp mill, 40-h.p. semi-Diesel engine,

air compressor and several good buildings. Ten to 15 men are employed.

Oro Fina has been the only important producer in the Ophir District in the past ten years. It is about four miles by road west of Auburn. The vein as a rule is about two feet wide, but pinches in places, forming lenses. Both walls are amphibolite schist to between the 600-ft. and 700-ft. levels, where the vein enters the granodiorite, which on the surface lies a short distance south. The vein was of lower grade in the contact zone, but reported of good grade where it entered the hard granodiorite, and was not displaced laterally.

The new shaft on Bullion No. 1 claim was sunk 730 feet and six levels were opened at 100-ft. intervals. The last owners, Oro Fina Mining Company, began work in 1913 and continued until January, 1922, when the death of the manager resulted in closing the mine and shortly after all machinery and equipment were removed.

The vein strikes a little north of west and dips 65° south. Levels were run east from 300 to 1400 feet and from 130 to 500 feet west, developing ore shoots on both sides of the shaft, one of them 150 feet and the other 250 feet long. The larger of these is east of the shaft, and No. 7 level was being driven to reach it, with several hundred feet still to go at the time of closing. This section is still well above the contact zone. The sulphide content of the vein averaged 1% pyrite, worth $60 a ton. The ore averaged within a few cents of $8 a ton between 1915 and 1921. The production for five years ending December 31, 1920, was $430,000. There was a good profit from operation until high prices incidental to war conditions ensued. The total cost of operation and development rose from $5.55 in 1916 to $7.85 a ton in 1917. The mill used (since removed) contained rock breaker, ten 1000-lb. stamps, and one each sand and slime concentrators. It had a capacity of 35 to 40 tons a day and made a satisfactory recovery, most of the gold being free. The ore of this mine appears to differ from that of many of the mines in the granodiorite nearby, which carry sulphides of lead, copper, zinc and silver. One small body of rich ore at the Oro Fina produced $90,000.

Pioneer Mine, on the south side of the canyon of American River, five miles south of Towle, is probably the deepest and most extensively worked quartz mine in the county. The steep topography permitted the use of adits, giving a depth of 1440 feet below the apex. Little work has been done in the past four years.

There are two veins, the Lynn and Pioneer, but most of the work was on the Lynn. It strikes N. 32° W. and dips 70° NE. The vein follows a strong dike most of the way, and this favors persistence in depth. This vein is one to ten feet wide, but averages four to seven feet wide in most places and is composed of good-looking ribbon rock. The footwall is hard black slate and the hanging wall grey slate and slaty schist.

No. 3 crosscut adit cuts the Pioneer vein at a distance of 390 feet and the Lynn vein at 1400 feet from the portal, and at a depth of 700 feet, and follows the latter 2525 feet. No. 7, 525 feet below No. 3, is a crosscut 2800 feet long to the Lynn vein and is drifted on that vein for 1475 feet. A winze is sunk 242 feet below No. 7 adit, showing the vein to be two to 9½ feet wide on the bottom level, where it was drifted 225 feet. Thirteen levels in all were run. Between No. 3 and No. 4 levels,

the vein was stoped nearly continuously for about 1200 feet. The North Lynn stope was 300 feet by 700 feet long and 1 to 4 feet in thickness was stoped; Lynn stope was 325 feet by 450 feet by one to six feet. There has been little mining below No. 5 level.

The ore milled has ranged from $3 to $16 a ton, running $10 to $16 a ton in the upper levels. It contains 2½% of pyrite, worth about $50 a ton. One section of vein 2½ inches wide above No. 7 level is reported to have yielded some ore worth $120 a ton.

The mill is 550 feet below No. 7 adit. It was built 40 years ago and it contains 9″ by 12″ breaker, twenty 1050-lb. stamps and six 4-ft. belt vanners. There is also a cyanide plant with a capacity of a ton a day for treating concentrate. Electricity brought from Towle was used for power in recent years. The later operations have been intermittent and the tramway from No. 7 to the mill, the electric power line and the mill are in need of repairs. The mine's production can not be definitely stated, but is believed to have been between $600,000 and $900,000.

Rising Sun Mine is a mile and a half west of Colfax. It was opened in 1866 and was operated until 1874 with a 5-stamp mill, and from then until 1880 with a 10-stamp mill, which crushed 12 to 15 tons a day. The production was over $2,000,000.

The vein averaged 18 inches wide in the upper levels and lies between hard diabase walls. It strikes northeast and dips 85° south to the seventh level, where it rolls over and reverses its dip in 20 feet. Below this roll the vein increases in width to four or five feet and becomes softer. The deepest shaft is 749 feet deep on the dip with ten levels. There are two other shafts to the west, one sunk to the fifth level and the other to the third. On the west of main shaft there was a pay chimney about 40 feet long, which is reported by a former superintendent to have been so rich in free gold near the cross fault that the gold literally held the quartz together. A north and south crossing or fault apparently bounded the rich ore on this side and had probably influenced its deposition. East of the shaft, pay was in stringers. On the west it paid well to the 700 level, where the roll occurred, but below there it is said to have milled $5 a ton.

The mine lay idle from 1884 to 1919, when a stock company erected a modern plant with a new 10-stamp mill and unwatered the mine. They were unable to keep the water out of the lowest level long enough to do any work and failed to find any new ore. They quit in 1921 after milling a few tons. Subsequently E. C. Klinker began further work and lately a long drain tunnel, planned and started 12 years or more ago, has been continued, and it was expected that this would be finished the present summer.

Spanish Mines, lying north of the Four Aces property, show a vein of barite, silica and talc in the form of a blanket divided into floors in which free gold occurs. It has a 2-stamp mill.

Snowbird Mine, near the old Sugar Pine mill 12½ miles northeast of Forest Hill, shows free gold in talc and serpentine with a little quartz. It is equipped with a 50-ton ball mill, five light stamps and a small cyanide plant. The company that put this equipment on it was unable to make it pay.

Following the plan used in our new set of county reports, the writer has not considered it necessary to enter into a description of each quartz mine in the county. This would involve the repetition of many details covered in past reports. It is also true that many mines in the same district or in the same geological formations have many characteristics in common, so that a description of one or two of each type, with the results obtained in their operation, gives the reader a good idea of what may be expected from others of the same type. The above notes summarize the results of quartz mining in the county since the reports of 1915 and 1920. The following table shows in compact form the name, location and ownership of all quartz mines and prospects and a bibliography of articles concerning them in our past publications. The quartz mines of the Ophir district were described in the Fourteenth Report of the U. S. Geological Survey, part two, and the areal geology of the county was mapped by that survey in its Sacramento, Placerville, Colfax and Truckee folios.

TABLE OF QUARTZ MINES AND PROSPECTS, PLACER COUNTY.

Name of mine	Location			Last owner's or operator's name, address*	Elevation, feet	Area, acres	Bibliography
	Sec	Twp.	Range				
Adams	20	12 N.	8 E	Calvin T. Adams, Newcastle	1,050		R. XIII, p. 272; XV, p. 331.
Alameda	25	14 N	9 E	J. F. Wise and Martin Partridge, Colfax	1,400		R. XV, pp. 331-332.
American Bar	33 4, 5	14 N 13 N	11 E 11 E	American Bar Quartz Mining Co., John McCandless, Pres., Harry A. Kunz, Secy., 858 Mills Bldg., San Francisco	1,800		R. XII, p. 294; XIII, p. 273; XV, p. 332; XVIII, pp. 261-262; XIX, p. 141; XX, pp. 13, 81-82, 179; Pre. Rep. 8, p. 31.
Anchor Mining Co.				C. N. Parmenter, Roseville			See Dorer
Andy Farrier Diggins							See Langstaff and Storey.
Annie Laurie	24, 25	14 N	9 E	Young & Major, Mrs. V. M., Weimar	2,000		R. XV, p. 332.
Australia	25	15 N	10 E	Australia Quartz Mining Co., c/o Eleanor Meeks, 1202 Arguello Blvd., San Francisco		77	
Bayonne	22, 26	13 N	9 E	Sheridan Brothers, Butcher Ranch	1,700		R. XV, p. 332
Bessey	9	15 N	13 E	Henry Snyder, Grass Valley	6,200	40	R. XV, p. 332
Bella Union	35	14 N	9 E	D. Jones, Clipper Gap	2,000		R. XIII, p. 273; XV, p. 332
Bellevue	7, 8	12 N	8 E				R. XIII, p. 274, see Oro Fina.
Belvedir	18	12 N	8 E	J. Kaiser, Ophir	1,000		R. XV, p. 332.
Big Ben Cons	25	13 N	6 E	Big Ben Cons. Mining Co., Lincoln		67	
Big Blue	3	15 N	10 E	Moody & Garety, Gold Run	3,050		R. XIII, p. 274; XV, p. 332
Big John	25	14 N	9 E	Ed. Bugley, E. B. Odell, M. L. Odell, E. H. and M. A. Hinchey, Weimar	2,200		R. XV, pp. 332-333
Big Oak Tree	33	15 N	9 E.	Wallace Werry, 2215 H St., Sacramento, and D. A. Russell, Colfax	2,300	9	R. VIII, p. 464; XIII, p. 274; XV, p. 333; XX, p. 179
Bishop							R. XIII, p. 274
Black Canyon	2, 3 8, 10	15 N 15 N	12 E. 12 E	Black Canyon Quartz Mining Co. of California, c/o E. B. Quigley, Forest Hill	5,500		R. XIII, p. 274; XV, p. 333.
Black Hawk	4	15 N	11 E	A. B. Chase, Towle, et al			
Black Oak	35	14 N	9 E	Black Oak Mine, c/o Elsie A. Drexler, 1068 Mills Bldg., San Francisco	1,875	80	R. XIII, pp. 274-275; XV, p. 334
Black Spanish No. 2	7	12 N	8 E	J. E. Walsh, East Auburn			R. XV, p. 344
Blue Bell	3	15 N	11 E	A. Percival Crittenden, Towle	3,000		R. XV, p. 344
Blue Jay	31, 32	14 N	11 E	Lorenzo de Marra, Butcher Ranch			
Blue Wing	28	15 N	10 E	W. A. Hilliard, Grass Valley	2,800	40	R. IX, p. 29; XV, p. 344.

Bonanza	11	15 N.	11 E.	Jerry J. Sullivan, San Francisco	3,200		R. XV, pp. 334-335.
Bonnie Bee	3	16 N.	11 E.	Bonnie Bee Quartz Mining Co., 744 Lake Shore Ave., Oakland	3,450		R. XV, p. 335.
Bonnie Bell	18	16 N.	11 E.	Bonnie Bell Quartz Mining and Development Co., Dutch Flat			
Booth	8, 9	12 N.	8 E.	Slosson & Spinney Estates, c/o E. P. Slosson,			
	16	12 N.	8 E.	Auburn	1,380	10	R. XVII, pp. 442-443.
Boulder	18	12 N.	8 E.	Jack Smith, Ophir	950		R. XII, pp. 205-206; XIII, p. 275; XV, p. 335.
Boulder							See Julian Mine.
Bree	2, 3	15 N.	11 E.	Wm. M. Bree			R. XVIII, p. 301.
Buena Vista	24	14 N.	9 E.	Ed. Bigley, Colfax	3,000		R. X, p. 426; XV, p. 335.
Bullion	7, 8	12 N.	8 E.		1,240		R. XIII, p. 275.
Bunker & Nihill	32	14 N.	11 E.	H. H. Bunker and J. A. Nihill, Michigan Bluff			R. XV, p. 335.
Burner	14	13 N.	9 E.	J. W. Burner, Forest Hill			R. XV, p. 335.
Burt							See Hathway.
Butts	21	12 N.	8 E.				R. VIII, p. 461; XIII, p. 276; XV., p. 335.
Calf Pasture	34	13 N.	8 E.	W. E. Dean, Kohl Bldg., San Francisco	1,000		R. XIII, p. 276; XV, p. 335.
California	16	12 N.	8 E.	Mr. Hubbell, Auburn			R. XIII, p. 276; XV, pp. 335-336.
Carter, Wallace & Augustine	33, 28	15 N.	13 E.	F. G. Albonos, Michigan Bluff, A. C. Lowell, San Francisco	5,900	62	Field Report.
Cash in Dump				H. M. Black and H. J. Ellert, Virginia City, Utah	5,400		R. XV, p. 336.
Centennial	17	12 N.	8 E.	Wm. Walsh, Auburn	1,180	10	R. XV, p. 336; XVII, p. 443; XVIII, pp. 263, 301-302.
Central	3	15 N.	11 E.	Central Mining Co., H. T. Power, Pres., Berkeley	2,200	21	R. XV, p. 336.
Champion	15	14 N.	11 E.	Daniel Webster Mining Co., c/o F. A. Leach, A. Dibble and Mr. Hampton, Michigan Bluff			R. XII, p. 206; XIII, p. 276; XV, p. 336.
Cherokee							R. XII, p. 206; XIII, p. 276; XV, p. 335.
Chicago	32	16 N.	14 E.	Tom Young, Cisco	5,200		R. XV, p. 336.
Chicago	35, 36	12 N.	7 E.	Estate of John F. Howard, Penryn			
Christmas Hill	26	13 N.	9 E.	J. A. Ware, Butcher Ranch	1,800		R. XV, p. 337.
Columbia							See Three Stars.
Conrad	17	12 N.	8 E.	Wm. Walsh, Auburn	1,150	15	R. XV, p. 337; XVII, p. 443; XVIII, p. 302.
Crandall	8	12 N.	8 E.	T. F. Jull, Auburn	950	37	R. XV, p. 337; XVII, pp. 443-444.
Crater Hill	12	12 N.	7 E.	George A. Aldrich, Auburn	1,200		R. X, p. 433; XII, p. 207; XIII, p. 277; XV, p. 337.
Crosby	25	13 N.	6 E.	F. C. Crosby, Lincoln		17	

*Due to various legal complications which may arise regarding ownership of unpatented mining claims, we do not vouch for absolute correctness of this column. The names are mostly those appearing on the tax rolls. To save space, frequently only one of several owners is listed.

TABLE OF QUARTZ MINES AND PROSPECTS, PLACER COUNTY—Continued.

Name of mine	Location			Last owner's or operator's name, address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Cuckoo	16, 4	14 N.	12 E.	c/o F. N. Tillotson, Michigan Bluff			
	9, 10	14 N.	12 E.				
Dahlonega	12	16 N.	11 E.	Dahlonega Mining Co., 470 Count St., San Bernardino	5,350	6	R. XIII, p. 277; XV, p. 337.
Daniel Webster	15, 16	14 N.	11 E.	Daniel Webster Mining Co., c/o F. A. Leach, A. Dibble and Mr. Hampton, R. H. Summers, Michigan Bluff	3,600		R. XII, p. 207; XIII, p. 277; XV, p. 337; XX, p. 13.
	22	14 N.	11 E.				
Debb	4	15 N.	11 E.	A. Percival Crittenden, Towle	3,850		R. XV, p. 338.
De Maria				C. J. deMaria and Mr. Garbe, Spring Garden			R. XV, p. 338; Pre. Rep. 8, p. 32.
Dewey	22	13 N.	9 E.			35	R. XV, p. 338.
Dewey & Stocker	30	14 N.	11 E.	Mrs. R. B. Howell, Auburn; Mrs. E. S. Jensen, Sacramento			R. XIII, p. 277; XV, p. 338.
Don Prospect				John Lass and Walter J. Wren, Virginia City, Utah	6,700		R. XV, p. 338.
Dorer	3	15 N.	11 E.	L. R. Dorer, Auburn	4,016		R. VIII, p. 468; XII, pp. 207-208; XIII, p. 277; XV, p. 338.
Drummond	1	14 N.	10 E.	Estate of C. F. Reed, J. E. Walsh, Freeman Hotel, Auburn	3,600		R. X, p. 424; XII, p. 208; XIII, p. 277; XV, p. 338; Pre. Rep. 8, pp. 31-32.
Dry Hill	31, 32	14 N.	11 E.	Clementina deMaria, McKeon			R. XV, p. 338.
Eagle	2, 3	15 N.	11 E.	Wm. M. Bree and Eagle Gold Mining & Milling Co., 427 Western Mutual Life Bldg., Los Angeles	2,000		R. XVIII, p. 301.
Eclipse	17	12 N.	8 E.	Eclipse Milling Co., Auburn	1,000		R. X, p. 433; XIII, p. 277; XV, p. 338; Bull. 50, p. 207.
Elizabeth				John Watson, Penryn			R. XVII, p. 445.
Ellen Dip							See Golden Scepter.
Eureka	13	12 N.	7 E.		900	69	R. XV, p. 339.
Eureka Cons.	1	13 N.	9 E.	C. F., Wm. and G. Seavey, W. A. Shepherd, H. Adams and G. Cothn, Forest Hill	2,000		R. XV, p. 339.
	31	14 N.	10 E.				
Falls Creek							See Chicago.
Fall Ravine	14	15 N.	13 E.	M. Savage, Forest Hill	6,000		R. XII, p. 208; XV, p. 339.

Flat Ravine	27	15 N.	13 E.	Flat Ravine Quartz Mine, 242 Polk St., San Francisco			R. XII, p. 208; XIII, p. 278.
Four Aces				M. Savage and Four Aces Mines Co., Forest Hill			(Herein.)
Galma, Patrick & Patrick extension, Tunnel Mine				Black Canyon Quartz Mining Co., c/o E. B. Quigley, Forest Hill			See Black Canyon.
Garbe							See deMaria.
Gem	2	15 N.	11 E.	John Rablin, Dutch Flat	3,200		R. XV, p. 339.
Gold Blossom	12	12 N.	7 E.	Reed Estate, Auburn; J. H. Toler, Mgr.; A. C. Lowell, executor	700		R. X, pp. 431, 433; XII, p. 209; XIII, pp. 278-279; XV, pp. 339-340.
Golden Eagle				Mrs. Thos. Bailey, Box 245; Nevada City, et al.			R. VIII, p. 464.
Golden Reward	5	15 N.	13 E.	Mrs. Wm. Bell & Son, Westville	6,000	20	R. XV, p. 340.
Golden Rule	17	11 N.	8 E.	Wm. Kendall, Sacramento	750		R. XV, p. 340.
Golden Scepter	3	13 N.	8 E.	Ed. Vore, Applegate and E. Ephraim	1,625		R. XIII, p. 279; XV, p. 340.
Golden Sheaf	27	14 N.	11 E.	Golden Sheaf Mining Co., E. P. Thompson, Mgr., Michigan Bluff			R. XV, p. 340.
Golden West	25	16 N.	11 E.	Reuben H. Lloyd, San Francisco	3,000		R. XV, p. 341.
Gold King	8	15 N.	13 E.	Jas. G. Dodds, Elizabeth Bell and Nels Forthun, Westville	5,860	20	R. XV, p. 340.
Great Eastern	20	16 N.	12 E.	Great Eastern Quartz Mine, Emigrant Gap		15	
Great Western	21	15 N.	13 E.	Great Western Mining Co., Mr. Kelly, Pres., Martin Winters, Secy., Pier 36, North River, N. Y.	5,000	270	R. XV, p. 341.
Green	8	12 N.	8 E.	Wm. Kendall, Dutch Flat			R. XII, p. 209; XIII, p. 280; XV, p. 341.
Green Emigrant	29	13 N.	8 E.	R. A. Nicol, 67 Sunshine Ave., Sausalito	1,600	10	
Hancock & Watson							See Dewey & Stocker.
Hannaman				G. B. Hannaman, Auburn	1,200	120	
Hathway	18	12 N.	8 E.		675	24	R. X, pp. 429-431; XIII, p. 280; XV, p. 341.
Herman	16	15 N.	12 E.	J. T. Curry, Forest Hill	4,500	1,448	R. VIII, p. 472; IX, p. 29; XII, p. 211; XIII, p. 280; XIV, pp. 341-342.
Hernut	30	15 N.	18 E.	John Lass, Summit	5,500	20	R. XV, p. 342.
Hope	17	12 N.	8 E.	Andrew Johnson, Ophir	1,142		R. XV, p. 342.
Huntville Cons.							R. XIII, p. 281.
International	12	13 N.	9 E.	Patrick McInnis, Butcher Ranch			R. XV, p. 342.
Joe Dandy				John Lass, Virginia City and L. D. Heath, Los Angeles	6,936		R. XV, p. 342.
Julia	3	15 N.	11 E.	J. D. Sullivan and A. P. Crittenden, Towle			R. XIII, p. 281; XV, pp. 342-343.
Julian	7	12 N.	8 E.	Mrs. Martin Schnabel, Newcastle			R. XV, p. 343.

*Due to various legal complications which may arise regarding ownership of unpatented mining claims, we do not vouch for absolute correctness of this column. The names are mostly those appearing on the tax rolls. To save space, frequently only one of several owners is listed.

TABLE OF QUARTZ MINES AND PROSPECTS, PLACER COUNTY—Continued.

Name of mine	Location			Last owner's or operator's name, address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Kettler	12	12 N.	7 E.		1,000		R. XIII, p. 382.
Lady Bedford							See Rip Van Winkle.
La Follette	7, 8	15 N.	13 E.	Henry Snyder, Grass Valley	5,930	20	R. XV, p. 343.
Langstaff & Storey							Pre. Rep. 8, p. 32.
La Trinidad	34	16 N.	13 E.	George Montgomery, Mills College P. O., California	6,000		R. XV, p. 343.
	2	15 N.	16 E.				
Liberty	30, 31	15 N.	14 E.	C. W. Cross; Wm. Maguire, Nevada City			
Little Banner	22	12 N.	8 E.	Charles Glover			R. XV, p. 343.
Little Cougar	33	15 N.	9 E.	D. B. S. Wilcox, Colfax		18	
Live Oak	23	14 N.	9 E.	G. and W. P. Geisendorfer, Weimar	2,000		R. VIII, pp. 474-475; IX, p. 29; XIII, p. 282; XV, pp. 343, 364.
Lost Emigrant	32	16 N.	14 E.	F. L. Heath, Donner P. O., Placer county, California, et al	6,700		R. XV, p. 344.
Lundquist	16	12 N.	8 E.	Mrs. Lundquist, Auburn			R. XIII, p. 282; XV, p. 344.
Lynn				(Part of Pioneer)			R. VIII, p. 468; See Pioneer also.
Malmberg	16	12 N.	8 E.	J. Malmberg, Auburn			R. XIII, p. 282; XV, p. 344.
Marguerite	3	12 N.	8 E.	Unknown—sold to state	1,360		R. XII, p. 210; XIII, pp. 282-283; XV, p. 344; XVIII, p. 45.
Mars				Sam Wolford, Grass Valley	2,428	80	R. XV, p. 334.
Midas							See Shady Run.
Minna Rosa	17	12 N.	8 E.	J. E. Walsh, East Auburn	1,000		R. X, p. 433; XV, p. 345.
Mitchell				H. F. Adams, Forest Hill and estate of Ben Tabor, Auburn			R. XV, p. 345.
Mollie or Mollie Stark	21	12 N.	8 E.	Mrs. Asa B. Eastwood, Newcastle	850		R. XV, p. 345.
Moore	17	12 N.	8 E.	J. M. White, Auburn	1,050		R. XIII, p. 283; XV, p. 345.
Nob Hill							See La Follette.
No Chunk							R. XIII, p. 284.
North Star	22	13 N.	9 E.	E. J. Power, E. J. Young and Henry F. Power, Berkeley	1,700		R. XV, p. 345.
North Star				North Star Mining Co., c/o Chas. Thomas, Box 107, Truckee			
Number Two	10	15 N.	10 E.	E. A. Moody and Mr. Garety, Gold Run	2,875		R. XIII, p. 284; XV, p. 345.
Ohio							R. VIII, p. 480.
Old Pacific	25	12 N.	7 E.	Mrs. Martin Schnabel, Newcastle			R. XII, p. 244; XIII, p. 284; XV, p. 345.

Oro Fina	7, 8	12 N.	8 E.	Mrs. Haines Gridley, Auburn	1,140	96	R. XIII, p. 274; XV, p. 345-346; XVII, pp. 445-446; XVIII, p. 7; Pre. Rep. 8, p. 32.
Osborne							See Herman.
Ostrom							See Blue Wing.
Pacific Slab							See under Placer Mines.
Page & Buckman							See Rip Van Winkle.
Paragon							See under Placer Mines.
Patrick Cons	10	15 N.	12 E.	G. W. Snyder, Damascus	4,800		R. XV, p. 347.
Pioneer Cons	3, 4 9, 10	15 N.	11 E.	Pioneer Mining Co., Room 525 Clunie Bldg., 519 California St., San Francisco	3,800	728	R. VIII, p. 468; X, p. 426; XII, pp. 211-212; XIII, p. 284; XV, p. 347; XVIII, p. 302; Pre. Rep. 8, p. 32.
Prairie Flower	9	15 N.	13 E.	Mrs. Wm. Bell & Sons, Westville	5,800	40	R. XV, p. 347.
President Wilson	20	15 N.	12 E.	J. W. Cairns, Weimar	5,200	120	
Pritchard Gravel							See Blue Wing.
Providence							R. XX, p. 179.
Queen Sabe	9	15 N.	13 E.	Peter Hinst and J. G. Dodds, Westville	5,300	40	R. XV, pp. 347-348.
Rawhide	4	15 N.	11 E.	Canyon Mines Corp., Hotel Sutter, San Francisco	3,400		R. XV, p. 348; XVIII, p. 302; Pre. Rep. 8, p. 32.
Razzle Dazzle	20	12 N.	8 E.	G. L. Threlkel, Newcastle	950		R. XV, p. 348.
Reciprocity	11	12 N.	7 E.	I. Meyer, Lincoln	595		R. XV, p. 348.
Red Bird Cons	24	14 N.	9 E.	G. A. Tubbs, Colfax	2,000		R. XV, p. 348.
Red Rock	24	16 N.	11 E.	N. B. Willey, Blue Canyon	4,200		R. XIII, p. 285; XV, p. 348.
Rip Van Winkle	28	15 N.	12 E.	Martin S. Buckman, Shelbina, Missouri	3,200	42	R. XII, p. 210; XIII, p. 282; XV, p. 348.
Rising Sun	33, 34	15 N.	9 E.	Benj. E. Valentine	2,290	440	R. VIII, p. 462; XIII, p. 285; XV, p. 349; XVII, pp. 446-447; XVIII, p. 7; Pre. Rep. 8, pp. 32-33.
Roosevelt	4	15 N.	14 E.	F. L. Heath, Donner, et al			R. XV, p. 349.
Rublin	34	15 N.	12 E.	Messrs. Foley, McCarty & Caren, Chicago			R. XV, p. 349.
Ruby	25	14 N.	9 E.	E. H. Hinchey, Weimar	2,200		R. XV, p. 350.
Saint Lawrence	7	12 N.	8 E.	Reed Estate, Auburn	1,000		R. XV, p. 350.
Salig	3	12 N.	8 E.	A. L. Smith, Auburn	1,200		R. XV, p. 350.
Salsic	3	12 N.	8 E.	Smith & Fulweiler, Auburn	1,300		R. XII, p. 212; XIII, p. 285; XV, p. 350.
Secret Town	10	15 N.	10 E.	E. A. Moody and J. E. Everhart	2,875		R. XIII, p. 285; XV, p. 350.
Senator Gold and Copper				J. W. Cairns, D. M. Kennedy, Weimar, and C. E. Van Giesen, Applegate	2,000	80	Field Report.
Shady Run	27, 28	16 N.	11 E.	Shady Run Mining Co., Joseph Fyfe, agent and trustee	2,700	640	R. XV, p. 350.

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TABLE OF QUARTZ MINES AND PROSPECTS, PLACER COUNTY—Continued.

Name of mine	Location			Last owner's or operator's name, address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Sheridan							R. VIII, p. 468.
Smith & Fulweiler							See Subsic.
Snowbird	21	15 N.	11 E.	George McCullough & Lewis, Forest Hill	3,950	20	R. XVII, p. 447; Pre Rep. S, p. 33.
Snowflake							See Prairie Flower.
Southern Cross	4	15 N.	11 E.	R. L. Ford, Towle; A. W. Nicholls, Berkeley			R. XII, p. 212; XIII, p. 286, XV, p. 80.
Spanish	7	12 N.	8 E.	Reed Estate, Auburn	1,050		R. XIII, p. 285; XV, p. 351.
Spanish	25, 26	14 N.	11 E.	E. A. Garrison, Forest Hill	2,850	143	Field Report.
St. Lawrence	30, 31	14 N.	11 E.				
	7	12 N.	8 E.		1,000		R. VIII, pp. 461-462; XII, p. 212; XIII, p. 286.
Sterrett							See La Trinidad.
Sumpter							R. VIII, p. 475.
Texas	20	16 N.	12 E.	Halsey Estate, Towle; J. L. Gould, Alameda, Pres.	5,600		R. XIII, p. 286; XVIII, p. 286, XV, p. 351.
Three Stars	2	12 N.	7 E.	Columbia Gold & Silver Mining Co., E. H. Vance, 1911 Webster St., Oakland	650		R. XII, p. 206, XIII, pp. 276-277; XV, p. 351.
Tiger, Buena Vista and Ruby	25, 27	14 N.	9 E.	F. H. Hinchey, Weimar	2,200	23	R. XV, p. 351.
Tryon	1	15 N.	10 E.	Dr. W. M. Tryon, 409 Pacific Bldg., San Francisco and W. N. West, Towle		24	
Two Orphans	30	13 N.	8 E.	Ed. Bell, Auburn	1,480	21	Field Report.
Tyler							R. XV, p. 351.
Van Avery	14	16 N.	11 E.	L. Ballet, San Francisco	4,625		R. XV, p. 351.
Van Gieson	10	13 N.	8 E.	C. E. Van Gieson, Applegate	1,800	41	Field Report.
Washington	30	14 N.	11 E.	A. M. Nihill, Nevada and Jack Nihill, Michigan Bluff	3,400		R. VIII, pp. 466-467; XII, p. 286; XV, pp. 351-352.
Westlake	14 mi	SE. of C	isco	M. Westlake			
White Oak	14	11 N.	10 E.	J. N. Barton, Jr., Estate	2,810	80	Field Report.
Wubbena	32	16 N.	14 E.	Herbrant, Eustice & Co., Woodland	6,500		R. XV, p. 352.

*Due to various legal complications which may arise regarding ownership of unpatented mining claims, we do not vouch for absolute correctness of this column. The names are mostly those appearing on the tax rolls. To save space, frequently only one of several owners is listed.

GOLD (PLACER MINES).

Claude Chana is credited with the discovery of gold in Auburn Ravine (then Woods Dry Diggings) near the present town of Auburn, May 16, 1848, shortly after Marshall's discovery at Coloma. The shallow placers were often fabulously rich. Hundreds of bars along the North and Middle Forks of American River were worked, and numerous small streams in all parts of the county were highly productive. Beginning about 1857, after the surface placers were in large part exhausted, the rivers were turned from their beds, which have been thoroughly mined. Hydraulic mining began at Yankee Jim's in 1852, with a canvas hose and a small quantity of water, under a head of only about 50 feet. This camp, on the north side of Forest Hill ridge, and Michigan Bluff and Todd's Valley on the south side, were pretty well worked out by 1868. The opening of the series of buried ancient channels lying under the andesite which covers the Forest Hill divide and its northeasterly extension, followed closely on the working of the surface placers. Where the miner followed the gold-bearing gravel until it disappeared under the surface, circumstance would dictate the method of mining to be followed. Should a good supply of water be available, and the amount of overburden to be handled not seem too great in proportion to the gravel, it might first be hydraulicked and this method was also followed where the gravel was too low grade to 'drift.' But with a rich and perhaps small pay streak and with perhaps several hundred feet of overburden, often composed of volcanic material too hard to hydraulic, the only feasible method of working was to 'drift,' that is, to follow the pay streak by adits along the bedrock of the ancient stream, or in the hard bedrock below the gravel, which was extracted by means of raises, cross adits and breasts. This method of mining reached its highest development in the mines of the Forest Hill divide and the adjacent districts, notably at Sunny South and Damascus. In many claims, both hydraulic and drift mining were resorted to. Michigan Bluff, Todd's Valley, Yankee Jim's, Dutch Flat and Gold Run were pre-eminently hydraulic mining camps, while Forest Hill and Iowa Hill were known for their drift mines. Forest Hill district has been the most productive drift mining camp in the state. It was stated in 1868 that the mines within rifle-shot of the post office there had produced $10,000,000. In 1859 this camp shipped $100,000 of gold dust a month.

The principal placer mining districts, their estimated gold production and the production of some of the more-noted individual mines, are as follows:

Forest Hill district proper	$12,000,000

of which the following mines were the principal contributors prior to 1868, according to Rossiter W. Raymond:[1]

Dardanelles (principally drift)	$2,000,000
Mayflower	1,500,000
New Jersey	850,000
Independence	450,000
Deidesheimer	650,000

[1] Raymond, R. W. Mineral Resources of U. S. West of Rocky Mts., 1868.

Fast & Nortwood	$250,000	
Rough & Ready	250,000	
Gore	250,000	
Jenny Lind	1,100,000	
Bath (Paragon drifting, $1,750,000; hydraulic, $500,000)		$2,250,000
Todd's Valley (hydraulic mines)		5,000,000
Yankee Jim's, Georgia Hill (hydraulic mines)		5,000,000
Iowa Hill Divide (hydraulic and drift mines)		10,000,000
Damascus district (drift)		6,000,000
Hidden Treasure Mine (drift)		3,500,000
Michigan Bluff, Byrd's Valley (hydraulic)		5,000,000
Gold Run (hydraulic)		3,000,000
Dutch Flat (hydraulic)		3,000,000
Last Chance district (principally El Dorado Mine)		2,500,000

The last large producer operated among the drift mines was the Hidden Treasure, which continued working until late in 1914. Since that time the placer gold production has come mainly from the dredgers operated along the Middle and North Forks of American River. Drift mining and gold production therefrom have been on a small scale in recent years. There has been some work near Forest Hill, Deadwood and along Duncan Canyon, the last named in the eastern part of the county in the high mountains. The keeping of definite annual statistics of gold production in California began in 1880. The figures for Placer County appear herewith. All of this except about $3,500,000 from gold quartz mines and about $1,000,000 from dredgers, came from placer mines. The last dredger operated in the county was being moved in June, 1927.

Geology.

The subject of geology of the auriferous gravel deposits, and especially the buried channels, has been covered in detail in the State Mining Bureau's past publications. The ancient channels of the Forest Hill and Iowa Hill divides were described in detail in the Ninth and Tenth Reports of the State Mineralogist, in articles by John Hays Hammond, Ross E. Browne and J. B. Hobson. These reports are accompanied by excellent maps, showing the geology of the districts, the location of channels, the location and extent of work done upon them at the various mines, and much other valuable information.

After seventy-five years of working such deposits, many of the drift mining districts of the county remain a baffling puzzle. In the popular mind, placer mining has always been considered simpler and calling for the exercise of far less technical skill than quartz mining. This is certainly not true as regards drift mining. In such districts as the Forest Hill divide, the drainage systems of hundreds of thousands and perhaps millions of years were finally blotted from sight by such covering of later volcanic effusions that the old topography was completely hidden. Subsequent erosion has greatly altered the face of the country, but the mantle of andesite, immense enough to conceal entire river systems, still conceals channel segments of possible value of which we know nothing.

The amazing geologic complexity of the series of stream and volcanic deposits between the bedrock of the Cretaceous and the present surface is appreciated by few.

In addition to the channels whose gravel deposits are rich enough to work profitably, there are many others which will not pay under existing circumstances. The general conditions which governed this most important feature, the gold content, are wrapped up with the geology of the ancient bedrock surface of the country over which the now buried rivers flowed, and the sequence and interrelations of the channels. They may be summarized in a few words.

The most ancient of the deposits were in the large rivers which carried on their work of erosion for probably millions of years without interruption. They accumulated in their broad beds immense amounts of debris from the erosion of the Cretaceous surface, where were exposed the earlier gold-bearing rocks. While the parts of the county principally traversed by these streams have produced no very large rich quartz mines, there are numerous gold-bearing veins and pockets and auriferous schists. The amount of rock torn down and carried off in the streams was so tremendous that much gold was collected in the stream beds. The mountains were reduced to probably one-third their original height and most of the great central valley was filled with the lighter and finer-sized fragments. Most of the rocks were so susceptible to erosive agencies that they were carried off entirely and only the more resistant, of which quartz was the commonest, remained in the higher parts of the stream courses, and gave the deposits their character of 'quartz channels.' These primary channels have been the most productive, as a whole. After their courses had been choked by the first of the volcanic outbursts, there began a period when erosion was interrupted frequently, as compared with the pre-volcanic era. The streams often did not have time to even cut their channels to bedrock before they were again choked by volcanic debris. But where they could erode deeply enough to reach the primary channel, they became rich in gold below the crossing, often richer than the original channel, as their gravel then was reconcentrated. But unless and until it made such a crossing, or reached bedrock, the later channel was apt to be disappointing to the miner. Another class of channel is the steep and narrow gulch deposit found in some of the higher districts. These resemble present-day streams in the same regions, but are covered by the later lava flows. Where present rivers removed miles of the primary channels, they in turn became rich in gold below the crossings, forming the deposits first worked by the pioneers. These streams cut trenches 2000 to 2500 feet deep, passing through the volcanic capping and eroding the bedrock formations, in which gold-bearing veins occur, to a depth of 2000 feet in places. The gold content of the primary ancient channels and of the present streams depended on the gold content of the bedrock, and the best mines were below the regions where these streams crossed the pocket and quartz veins.

There is printed herewith a directory of placer mines and prospects, giving the names, locations and ownerships of practically every placer mine in the county, together with reference by name of publication and page, to this bureau's reports describing past mining operations.

The mines of the Duncan Canyon district were described, and a map of the district published in our "Mining in California" for July, 1925. The vexed question of hydraulic mining in this and nearby counties has been discussed in detail by Arthur Jarman in the report of the California Hydraulic Mining Commission, which was reprinted in our quarterly, "Mining in California," for January, 1927. There remains to mention only the few small operations not covered in other reports cited in the directory.

Big Dipper. The last work on this old drift mine near Iowa Hill was done by A. D. Hadsel in 1920–21. Results were disappointing, and the property is idle.

Blue Eyes Prospect in Duncan Canyon was prospected for several years by Gold Dollar Mining Company, under option to purchase. The Gold Dollar adit on the Gold Dollar claim near the southwest end of the 2580 acres in this group was run 2300 feet in a direction a little west of north. This was in search of one of the steep channels, similar to that mined at the Glenn. Several bodies of gravel were opened and worked in a small way in the past on the claims now included in the Blue Eyes. The last work failed to find any payable deposit, and developed no buried channel.

After driving this adit, the company advanced the Jack Robinson adit to a length of 1300 feet on the Jack Robinson claim, three-fourths of a mile east of the Gold Dollar adit. (See map, in "Mining in California," July, 1925.) There are heavy, water-worn boulders, indicating a large channel (which is probably the Chalk Bluff channel) in the outer part of this adit, which was started years ago. It was above bedrock at the start, and, according to S. S. Caples, one of the owners, bedrock was never reached in the last work, which is reported 14 feet above the bedrock at the face. The company gave up the property early in 1927.

Boles Placer is a river claim of 100 acres about three miles upstream from Rattlesnake Bar on the Middle Fork of American River and five miles south of Auburn. This section of the river was extensively worked by damming the river and diverting the flow at the time of low water in summer and autumn through large flumes. It is believed that sections of the river on this claim were never worked out. The owners are using the same system of prospecting which was followed in 1924 and 1925.

A 40-h.p. gasoline engine and 6-inch centrifugal gravel pump and a small engine, air pump and air hose for a diver are installed on a barge which is anchored in the middle of the river by cables. An overhead cable spans the river and a hoist and engine on shore operate a steel scoop which can be lowered into the river and can be filled with coarse rock by the diver. The suction nozzle from the pump is directed by the diver, who wears the regular deep-sea outfit. Any rock small enough to pass the pump is readily handled. The pump discharges its mixed load into the head of the sluice boxes, about six feet above water level, giving ample water for washing the gravel and sufficient dump room to permit discharging tailing on the bank downstream. Work can be carried on only when the water is clear and warm enough to permit a diver to remain below several hours. Two divers alternate under

water. Some of the previous work here was done under 20 to 24 feet of water. On account of their loss in weight in water, large boulders can be handled much easier than on land.

Carmack Placer Mine, near Robertson's Flat, will be prospected this season by Mrs. George W. Carmack, Seattle. No work except assessment labor has been done for several years, but a good prospect is said to have been found last season.

Double-O Mining Company has been prospecting the old drift mines at Deadwood.

Excelsior Mine was last extensively prospected by the late Haines Gridley as trustee between 1915 and 1921. In the early days the Forest Hill channel, a front channel or bench system of the primary channel, which contributed a large part of the gold taken from the Forest

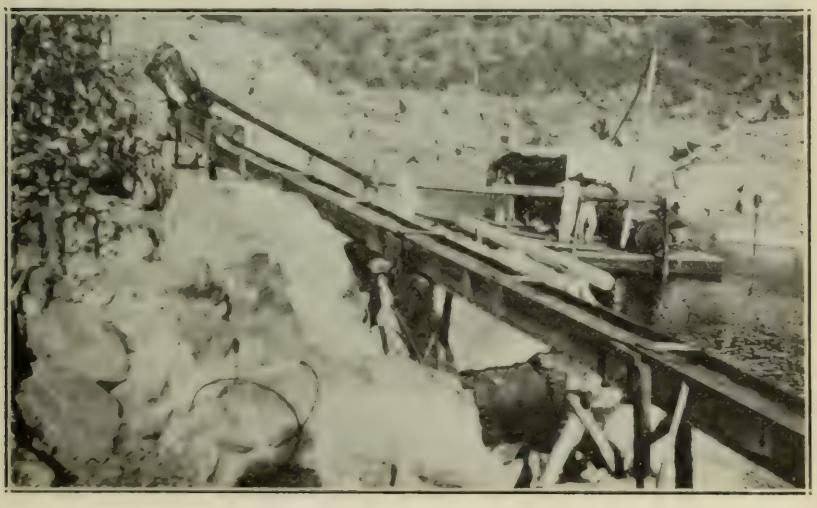


PHOTO NO. 6.

Equipment used at Boles Placer Mine on American River to prospect under water. The diver worked under deep water near the point where the blocks and cable are suspended (right), directing the suction hose and loading the large boulders.

Hill district, was worked in a number of claims through tunnels entering from the south side of the ridge. This bench system or earlier and higher channel of the primary system was cut off by the later and deeper blue lead and the work in later years has been for the purpose of finding the westward extension, if any, of the earlier channel, and also to prospect upstream on the Deep Blue Lead. The latter proved to be a much wider deposit than anticipated, and in the length of channel prospected, between 400 and 500 feet upstream, did not yield gravel rich enough to pay a profit, according to Gridley. The westward extension of the earlier channel was not picked up, and Gridley's work did not reach the top of either rim of the wide channel. Some later work has been done without conclusive results. This holding includes claims

along the south front of the lava cap from the Dardanelles to the Gore, also the Excelsior, Banner and Garland Mill Slope claims. An early resumption of work is planned.

Glenn Mine, in the Duncan Canyon district, has remained almost the only producing drift mine in the county for several years. The upper workings are still mined by lessees, while F. Tillotson and associates have continued operation of the lower workings. There has been little change since the report on the mines of that region in our "Mining in California," July, 1925.

The Glenn channel is steep and narrow and the gravel is mostly of hard schist, with little quartz in it. In the lower workings on the Outlet claim the pay gravel is 12 to 15 feet wide and ranges from nothing to 2½ feet thick, being overlain by coarse volcanic sand, which in places closes directly down upon the hard, polished schist bedrock. The gold



Photo No. 7.

Lower tunnel, Glenn Mine.

here was mostly in the crevices of the bedrock. In the upper workings, in the Shields tunnel, the bedrock rises 140 feet in 1500 feet, there being many sheer drops of several feet, evidently waterfalls in the old channel. The Moss crevice, in this tunnel, is said to have yielded $9,000. In flatter stretches of channel, gravel accumulated, and one body 200 feet long and up to 35 feet wide was breasted.

Georgia Hill Gravel Mine, near Yankee Jim's, was prospected in 1919 and 1920 by Georgia Hill Gold Mining Company, Inc., headed by Anthony Crafton. A tunnel 1400 feet long was run, a raise put up 206 feet and about 200 feet of drifting done. Part of the ground had been hydraulicked in early days, and the object was to prospect the channel ahead of the face of the old pit. Results were disappointing. The claims under lease in 1920 included the Buchanan, Trafton, Kerr, Armbruster, Gillespie and Adams, and 757 acres were under option.

Grey Eagle Mine, west of Forest Hill, was prospected by a subsidiary of Chief Consolidated Mining Company in 1915 and 1916. They reported a channel 50 to 80 feet wide, but that the value of gravel was not satisfactory.

Samuel Laird Ranch, east of Loomis, contains a shallow gravel deposit which was worked about 1912 by one of the most complete hydraulic elevator systems ever used in the state. Electricity was used to furnish power for pumping water. On account of the fluted granodiorite bedrock, it was difficult to deliver gravel to the elevator. About 1922 A. F. Thebo installed a drag-line bucket outfit operated by steam, but was unable to handle the ground because of insufficient power.

On the *Smyth Ranch* at Horseshoe Bar on the American River, 5½ miles east of Loomis, Mark Cameron, J. H. and C. A. Gossett and others



PHOTO No. 8.

New form of rake for moving boulders and cobbles, used by Cameron, Gossett and associates in placer mining at Smyth Ranch.

have just completed a test of gravel by methods illustrated in the accompanying pictures.

Water for a giant was pumped from American River with a 10-inch centrifugal pump, using a 75-h.p. tractor for power. The giant was used to pipe the gravel into a pit, from which it was drawn by an 8-inch centrifugal pump, which lifted it 25 feet into 80 feet of sluice lined with 2-inch by 3-inch iron-faced riffles. For clearing coarse cobbles from the pit, and from the gravel before reaching the pit, a specially designed rake was used. It weighs 4700 pounds, consists of 11 curved prongs of 1¼-inch by 5-inch iron spaced six inches apart, and measures about five feet wide by seven feet long. The gravel pump was operated by a 60-h.p. tractor, and another tractor of the same size operated the rake, which was fitted with a drag-line cable rig. The rake moved one-half to two-thirds cubic yard of boulders at a trip.

The operation was of interest principally because of the equipment used, as the ground worked was disappointing.



PHOTO No. 9.

Part of outfit used at Smyth Ranch for prospecting gravel.

TABLE OF PLACER MINES AND PROSPECTS, PLACER COUNTY.

Name of mine	Location			Last owner's or operator's name, address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Acacia	14	15 N.	11 E.	George McAulay, Auburn			R. XV, p. 379.
Alabama				Estate of P. D. Winter, 530 Twenty-second Ave., San Francisco			
Allbright	36	12 N.	7 E.				R. XII, p. 204; XIII, p. 272; XV, p. 352.
Alta	36	16 N.	10 E.	Alta Gold Mining Co., 1118 Broadway, Oakland	3,380		R. XII, p. 204; XIII, p. 272; XV, p. 352.
American Hill	24	15 N.	12 E.				R. XII, p. 204; XV, p. 352.
Argonaut & Sunset	22	14 N.	11 E.	C. E. Burns, Auburn			
Avalon	2	15 N.	13 E.		4,500		Abandoned.
Attulas	26	15 N.	10 E.	Attulas Mining Co., c/o C. F. Macy, Iowa Hill			
Azalea	22	16 N.	11 E.	c/o J. B. Knapp, Roseville	4,000	360	R. XIII, p. 275; XV, p. 352.
Baker Divide	7, 8, 9	14 N.	11 E.	Baker Divide Mining Co., 156 Montgomery St., San Francisco	2,838		R. VIII, p. 466; IX, p. 29; XIII, p. 273; XV, p. 352.
	16, 17	14 N.	11 E.				
Baker Ranch	17	14 N.	11 E.	F. B. Ellsworth, Baker Ranch	3,700		R. XV, p. 353.
Bald Mountain	21, 22	15 N.	13 E.	Ownership in dispute	5,800	160	R. X, p. 426; XIII, p. 273; XV, p. 353; XXI, pp. 276-277.
	28	15 N.	13 E.				
Baltimore et al	34, 35	14 N.	10 E.	Geo. McAulay, Auburn, et al		2,000	See Excelsior.
Banner	34	16 N.	10 E.	W. H. Rablin, c/o Wm. Rablin, 1405 J St., Sacramento	3,100		R. XV, p. 353.
Bartley Cons	26	16 N.	10 E.	Estate of Wm. Rablin, 1405 J St., Sacramento	3,100	110	R. XV, p. 353.
Bear River	4	15 N.	10 E.	W. H. Rablin, c/o Wm. Rablin, 1405 J St., Sacramento	2,500		R. XV, p. 379.
Bear River	14, 23	15 N.	9 E.	Bear River Gold Mining Co., 401 J St., Sacramento			
	12	15 N.	9 E.				
Bear River and Texas Hill Ext.	34	16 N.	10 E.	Grace A. Gould, Fremont Ave., Mountain View			
	21	16 N.	12 E.				
Bear River Extension	14	15 N.	9 E.	E. C. Uren, Nevada City	2,000		R. XV, p. 379.
Bear River Hill, Queen City and Dutch Flat Canyon	34	16 N.	10 E.	Arthur W. Nicholls			
Bear River Tunnel	12	15 N.	9 E.	Mrs. Chas. Voight, 1128 Tenth St., Oakland, and Wm. Nicholls, Jr.			

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TABLE OF PLACER MINES AND PROSPECTS, PLACER COUNTY—Continued.

Name of mine	Location			Last owner's or operator's name, address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Bear River Tunnel Co	6	15 N.	9 E.	W. H. Rablin, c/o Wm. Rablin, 1405 J St., Sacramento	2,200		R. XV, pp. 379-380.
	5, 6, 7	15 N.	10 E.				
Belle Verne	26, 35	15 N.	12 N.	George H. Smith, Last Chance	4,800	80	R. XV, p. 353.
Bolvit and American Eagle				Mrs. L. Bellows, Dutch Flat			
Ben Franklin	27	14 N.	10 E.	Joe Gilbert and R. C. Burry, Forest Hill	2,350	160	R. XII, p. 205; XIII, p. 274; XV, p. 353.
Big Bar	20	14 N.	13 E.				R. XV, p. 353.
Big Dipper et al	3, 4	14 N.	10 E.	McGeachin Placer Gold Mining Co., Capital Nat'l Bank Bldg., Sacramento	2,700	162	R. VIII, p. 472; X, p. 423; XII, p. 205; XIII, p. 274; XV, p. 374; XVII, p. 447; Bull. 92, pp. 135-136
Big Gun	22	14 N.	11 E.	W. S. Willey, Michigan Bluff			R. XIII, p. 285, XV, p. 354.
Bigler				Estate of James Abrams, c/o A. Dixon, 2322 W St., Sacramento			
Birds Flat	33	15 N.	10 E.	Henry Del Rey, Iowa Hill			
Black Hawk et al	13, 14	14 N.	10 E.	W. A. Freeman Estate, T. A. Nichols, Mgr., 206 Foxcroft Bldg., San Francisco	2,871	639	R. XIII, p. 274; XV, p. 354.
Blue Canyon							See Azalea.
Blue Channel	22	15 N.	10 E.	Blue Channel Mining Co.			
	32	15 N.	13 E.				
Blue Eyes Prospect	5, 7	14 N.	13 E.	S. S. Caples and Mrs. Emma Caples, 3634 Sixth Ave., Sacramento	2,800	2,530	R. XV, p. 354; XVII, pp. 447-448; XVIII, pp. 211, 603, XIX, p. 141; XX, pp. 13-14; XXI, p. 277; Pre Rep. 8, pp. 33-34.
	8, 17	14 N.	13 E.				
Bob Lewis	33	15 N.	12 E.		4,580	44	R. XIII, p. 275.
Bogus Thunder	19	14 N.	13 E.	S. S. Caples, 3634 Sixth Ave., Sacramento		250	R. XV, pp. 354, 380.
Bohes	34	12 N.	8 E.	W. Finch, E. L. Rene, Auburn, et al.		100	
Booth River	29	15 N.	10 E.	Booth River Mining Co., c/o E. Booth, Iowa Hill	1,300		R. XV, p. 380.
Bowen	10	14 N.	11 E.	Mrs. F. A. Bowen, 601 54th St., Oakland	3,400		R. XIII, p. 275; XV, p. 354.
Bradley & Gardner				Estate of Wm. Rablin, 1405 J St., Sacramento, et al.			
Breece & Wheeler							See Paragon.
Brooklyn and Olympia	26, 35	15 N.	12 E.	Messrs. Threlkeld and Blohm, San Francisco	4,580	235	R. XV, p. 354.
	36	15 N.	12 E.				

ull Run, North Fork and Bear River	35	16 N.	10 E.	Wm. Nicholls, Jr. et al.			
Burns	22	14 N.	11 E.	Michigan Bluff Mexican Cons. Mining Co., Wm. Burns, Secy., Placer County Bank, E. Auburn	3,500	200	R. XIII, p. 276; XV, p. 354.
California-Hawaiian Dev. Co.		13 N. et al.	12 E.	California-Hawaiian Dev. Co., 858 Mills Bldg., San Francisco		4,223	See Ralston Divide Gravel.
Cambridge	9, 16 17, 19 20	14 N. 14 N. 14 N.	10 E. 10 E. 10 E.	Mrs. Stemple, Colfax			R. XV, p. 380.
Canada Hill	4, 5, 9	15 N.	13 E.	E. Armstrong, Nevada City, et al.	6,300	310	R. XV, p. 85; XVII, pp. 444-445; XVIII, p. 602; XX, p. 13.
Canyon Creek	10	15 N.	10 E.	Stewart Gravel Mines, Inc., c/o J. D. Stewart, Auburn	1,310	10	R. XIII, p. 276; XV, p. 380.
Canothus	23	14 N.	10 E.	James Gavin, Forest Hill	2,950	39	Field Report.
Carey	22	15 N.	10 E.	F. S. Bonham and Wm. A. Pelster, Iowa Hill	3,200	120	R. XV, pp. 354-355.
Carmack	4, 5	15 N.	13 E.	Mrs. George W. Carmack, Seattle, Wash.	6,320	430	R. XV, pp. 368-369; XVII, pp. 448-449; XVIII, pp. 263, 603; Pre. Rep. 8, p. 34.
Cedar M.				Martha Thomas, Towle, and John Thomas			
Cedar Creek	3	15 N.	10 E.	J. L. Gould, Alameda	3,500	460	R. XII, p. 206; XIII, p. 276; XV, p. 355.
Collins	31	15 N.	10 E.	W. B. Fowler, Colfax			R. XV, p. 380.
Copper Bottom	25	15 N.	10 E.	J. D. Peters, 22 San Lorenzo St., Santa Cruz			R. XV, p. 355; XVIII, p. 211.
Dam	23, 26	15 N.	11 E.	Damascus Mining Co., Monadnock Bldg., San Francisco	3,715	174	R. XV, p. 355.
Damascus	14, 15 23	15 N. 15 N.	11 E. 11 E.	Hidden Treasure Mining Co.	3,748	1,548	R. VIII, p. 469; IX, p. 29, 120; X, p. 451; XII, p. 209; XIII, pp. 277, 281; XV, p. 355.
Dardanelles Cons	2	13 N.	10 E.	T. L. Chamberlain, Auburn	2,600	312	R. VIII, p. 464; IX, p. 29; X, p. 465; XII, p. 207; XIII, p. 277; XV, p. 355; Bull. 92, p. 136.
Dayton	27	15 N.	10 E.	M. E. Poor, Iowa Hill		10	
Devil's Basin	1 25	14 N. 14 N.	11 E. 10 E.	R. Lofruth, Deadwood; J. E. Ferguson, Michigan Bluff. Under option to Double-O Mining Co.	3,700		R. XIII, p. 282; XV, p. 355.
Devil's Gate				Chas. Pinoli, Forest Hill			XV, p. 356.
Dewey Cons	33, 34	15 N.	10 E.			137	R. XV, pp. 356-357.
Dixie Queen	9, 16	14 N.	13 E.	Joseph Scherer and John Franks, Last Chance; A. Morehead	4,000	240	R. XV, p. 357; XXI, pp. 277-278; Pre. Rep. 8, p. 34.
Double-O Mining Co.	31, 32	15 N.	12 E.	Doulbe-O Mining Co., H. R. Staples, Pres., P. O. Box 734, Oxnard		573	Pre. Rep. 8, p. 34.

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TABLE OF PLACER MINES AND PROSPECTS, PLACER COUNTY—Continued.

Name of mine	Location			Last owner's or operator's name, address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Daw	33	14 N.	10 E.	Mary Dow Stevens, 555 Bush St., San Francisco, et al.			
Dutch Flat Blue Lead	3	15 N.	10 E.	C. S. Jordan, Dutch Flat, and J. L. Gould, 16 Ensloe Ave., Alameda		80	R. XV, p. 357.
Dutch Flat Canyon	34	16 N.	10 E.	Mrs. H. L. Beal, 123 Terminal St., San Jose			
Dyer	35	16 N.	10 E.	Lewis A. Gould, Fremont Ave., Mountain View	2,800	20	R. XV, p. 357.
Eagle Bar				Wm. Duffy, Forest Hill			R. XV, p. 357.
El Dorado							See Pacific Gold Gravel.
Elite	31, 32	16 N.	11 E.	R. Monroe, Dutch Flat, et al.	3,950	425	R. XIII, p. 278; XV, p. 357
Erie	25	15 N.	9 E.	Erie Mining Co., c/o J. W. Morgan's Estate, Auburn			
Estey							See Rocky Bar.
Eureka Cons. Drift Mining Co.	8, 9 10, 17 18, 19 20, 24 25	15 N. 15 N. 15 N. 15 N. 15 N.	12 E. 12 E. 12 E. 12 E. 12 E.	Eureka Cons. Drift Mining Co., 519 California St., San Francisco	4,400	2,342	R. XIII, p. 278; XV, p. 357.
Excelsior				George McAulay, Auburn, et al.			R. XV, pp. 357-358.
Federal Drift	34	16 N.	10 E.	Federal Drift Mining Co., W. T. Watson, Supt., Dutch Flat, Dr. W. B. Coffey, Pres.	3,000	125	R. XV, p. 358.
Fermer	16, 18	13 N.	10 E.	R. R. Read, 812 Broadway, Oakland		240	
Fitzpatrick	32	15 N.	10 E.	M. E. Poor, Iowa Hill			R. XV, p. 359.
Florida & Tilton	25	14 N.	10 E.	A. Jones, 1615 Fifteenth Ave., Seattle, Wash.	3,550	109	R. XV, p. 359.
Flying Fish	34	16 N.	10 E.	John C. and Ed. Uren, 1016 N St., Sacramento	3,100	15	R. XV, p. 359.
Forest Hill Mining Corp.	15, 16 et al	14 N.	11 E.	Forest Hill Mining Corp., Box 734, Oxnard, lessee, with option, of Muir Cons.			
Foss							See Maguire.
Franklin	10	14 N.	11 E.	Geo. V. Nicholls, 2647 24th St., San Francisco	3,400		R. XIII, p. 278; XV, p. 359.
General Grant	33, 34	15 N.	10 E.	S. M. Sprague, 418 Twenty-fifth St., Sacramento, ⅔; Ben Rossi, Jr., 527 Twenty-eight St., Sacramento, ⅓			
Georgia Cons.	9, 10	14 N.	11 E.	D. M. Burns, 614 Crocker Bldg., San Francisco, et al.			
Georgia Hill Gravel Mining Co., Inc.	32, 33	14 N.	10 E.	Georgia Hill Gravel Mining Co., Inc., 207 Thayer Bldg., Oakland, J. F. Posert, Gen. Mgr.	2,450	757	XVIII, p. 211, Pre. Rept. 8, p. 34.

Gillett	31	15 N.	10 E.	F. N. Gillett, Colfax			R. XV, p. 380.
Gleason	9, 10	14 N.	10 E.	Mrs. M. Gleason, Iowa Hill	2,692		R. XV, p. 359.
Glenn Cons.	22, 27	15 N.	13 E.	Glenn Cons. Mining Co., George McAulay, A. K. Robinson, Auburn, et al	5,000	660	R. XIII, p. 278; XV, pp. 359-360; XVII, p. 449; XVIII, pp. 7, 603; XX, p. 13; XXI, p. 278; Pre. Rep. 8, pp. 34-35; Bull. 92, p. 140.
	28, 34	15 N.	13 E.				
Golden Dipper				Golden Dipper Placer Mining Co., 232 Fairgreen Ave., Youngstown, Ohio			
Golden Gate	22	15 N.	13 E.	L. & A. Borchart, 2413 I St., Sacramento			
Gold Dollar							See Blue Eyes.
Golden Channel	1	16 N.	11 E.	J. W. Hyatt, Emigrant Gap	4,800	480	R. XV, p. 360.
Golden Gem et al	15	14 N.	11 E.	A. K. Robinson, Auburn			
Golden Nugget	12	16 N.	11 E.	C. M. Everhart, Gold Run	4,000	640	R. XV, p. 360.
Golden River	12, 13	15 N.	11 E.	J. A. Ferguson, Forest Hill, agent for Societe des Mines de Golden River, Paris, France	3,827		R. VIII, pp. 470-472; IX, p. 29; X, p. 456; XII, p. 208; XIII, p. 279; XV, p. 360.
	14, 23	15 N.	11 E.				
	15	15 N.	11 E.				
	3, 4, 5	15 N.	12 E.				
	6, 7, 8	15 N.	12 E.				
	18	15 N.	12 E.				
Golden Shaft	35	16 N.	10 E.		3,175	9	R. XIII, p. 279.
Golden Star	24	15 N.	10 E.	Golden Star Mining Co., c/o N. E. Booth, Colfax		140	R. XV, p. 360.
Golden Streak	35	15 N.	10 E.	Golden Streak Mining Co., Estate of Henry Lobner, F. H. and Walter Schulze, F. D. Kuenzley and P. W. Crider, Colfax			R. XV, p. 360.
Golden West	4, 5	15 N.	13 E.	Golden West Cons. Mining Co., Grass Valley	6,500	400	R. XV, p. 361.
Gold Ring	1	15 N.	10 E.	Mr. West, Towle	1,500	63	R. XIII, p. 279; XV, p. 360.
Gorman et al	27	14 N.	11 E.	A. A. Gorman, Michigan Bluff		250	R. XV, p. 361.
Gould	23	15 N.	10 E.	Gould Placer Mining Co., c/o D. S. Steanberger, San Diego	2,200		
Gould Group	33, 34	16 N.	10 E.	Lewis A. Gould, Fremont Ave., Mountain View			
	3	15 N.	10 E.				
	23	16 N.	11 E.				
	5, 6, 7	15 N.	16 E.				
Great Channel							See Hermit.
Greek	1	15 N.	12 E.	Martin Burner, Forest Hill, et al			R. XVII, p. 449; Pre. Rep. 8, p. 35.
Grey Eagle	5, 6	13 N.	10 E.	Amelia C. Coughlin, Dutch Flat	2,400		R. XIII, pp. 279-280; XV, p. 361.
Grizzly Canyon et al	10	14 N.	10 E.	Chauncey H. Dunn, Sacramento		176	
Haney Cons	4	14 N.	13 E.	Thomas F. Haney, Last Chance			R. XV, pp. 380-381.
	33	15 N.	13 E.				

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TABLE OF PLACER MINES AND PROSPECTS, PLACER COUNTY—Continued.

Name of mine	Location			Last owner's or operator's name, address*	Elevation, feet	Area, acres	Bibliography
	Sec	Twp	Range				
Hard Cash	3, 9	14 N	13 E.	Estate of McCullough Brothers, Michigan Bar, and Charles Hilton, c/o Glen Mine, Last Chance	4,000	400	R. XV, pp. 361-362; XXI, pp. 278-279; Pre. Rep. S, p. 35.
Harrison							See Big Dipper.
Haskell	21, 28	12 N	8 E	Haskell Gold Mining Co., c/o Ed. Gaylord, Auburn, et al	1,200	180	Field Report.
Hazard	20, 21	14 N	11 E	Hazard Gravel Mining Co., M. E. McGeoghegan		222	
Hawk	28	16 N	11 E	Robert Watson, Blue Canyon	3,720	33	R. XIII, p. 280; XV, p. 362.
Heroine	3	14 N	11 E	Mrs. Bowen & Sons, Michigan Bluff	3,400		R. XIII, p. 280; XV, p. 362.
Hidden Treasure	26, 27	15 N	11 E	Hidden Treasure Mining Co., Harold T. Power, Secy., 625 Call Bldg., San Francisco	3,644	1,545	R. VIII, p. 469; IX, pp. 29, 120; X, p. 451; XII, pp. 209-210; XIII, p. 281; XV, p. 362; Bull. 92, p. 137.
Hogsback	2, 3	15 N	12 E	Compagnie des Mines et Minerals, 26 Rue de Chateaudun, Paris, France; J. A. Ferguson, agent, Forest Hill	4,525	1,545	R. VIII, p. 472; XIII, p. 281; XV, p. 363.
Homestake	31	14 N	11 E	M. Savage, Forest Hill	1,260		R. XV, p. 363.
Home Ticket	26, 35	15 N	12 E	J. F. Thompson, Bath, or Box 178, Long Beach, et al	4,700		R. XV, p. 363; XVIII, p. 211; Pre. Rep. S, p. 35.
House, Garden Claim, Yon Bet and Brown	33, 34	16 N	10 E.	George V. Nicholls et al			
Horseshoe Bar et al	4	13 N	11 E.	Horseshoe Bar Cons. Mining Co.		62	R. IX, p. 277; XIII, p. 281; XV, p. 382.
Iowa Hill and Byrds Flat	34	15 N	10 E	Mrs. J. McPherson, 1051 S. Flower St., Los Angeles			
Iowa Hill	26, 27	14 N	10 E.	Wm. Muir, Oakland			
Indian Hill	9, 10	15 N	10 E.	J. L. Sparhawk, Iowa Hill			R. XV, p. 363.
Irish & Byrne	3, 4	14 N	10 E.	McGeachin Placer Gold Mining Co., Capital National Bank Bldg., Sacramento			
Jack Robinson	16	14 N	13 E	S. S. Caples, 3634 Sixth Ave., Sacramento	4,070		R. XV, p. 364.
Jarvis	14, 15	15 N	11 E.	H. M. Jarvis, Mobile, Ala.	3,850	160	R. XV, p. 363.

Jupiter Cons	11	14 N.	10 E.	McGeachin Placer Gold Mining Co., Capital Natl. Bank Bldg., Sacramento		250	R. XV, p. 363.
Kelly	9	11 N.	8 E.	M. A. Kelly, Auburn			R. XV, p. 382.
Kinder River	28	15 N.	10 E.	Estate of T. L. Schwab, Iowa Hill			R. XV, p. 382.
Ladies Canyon				W. F. Ford, Forest Hill, c/o George S. Ford			
Laird River Claim				Sam Laird, Loomis			
Lebanon	3	14 N.	10 E.	Lebanon Mining Co., 404 Twenty-eighth St., Oakland; J. E. Walsh, Auburn	2,928	130	Field Report.
Lehigh	30	14 N.	11 E.	J. F. Thompson, Bath			R. XV, p. 382.
Bob Lewis							See Jarvis.
Live Oak	22	14 N.	10 E.	St. Clair	2,680		
Lofruth							R. XIII, p. 282; See Devil's Basin.
Lost Camp	23	16 N.	11 E.	E. T. Robie, Auburn; George F. Miller, Blue Canyon, et al	4,500	600	R. XIII, p. 282; XVII, p. 451; XV, p. 364.
Lucky George	16	14 N.	13 E.	M. Savage, 1242 Polk St., San Francisco		40	
Macedon	1	15 N.	12 E.	Kate F. Johnson, 2411 Hillside Ave., Berkeley; Mrs. Agnes Snyder, Forest Hill, et al	5,000	100	R. XV, p. 364; XVII, p. 449; Pre. Rep. 8, p. 35.
Mad Canyon, New York Bar, Apache				Marsh Lowell, Auburn			
Maguire				Mr. and Mrs. Wm. Maguire, Nevada City			R. XV, p. 364.
Manhattan-Michigan	15, 16	14 N.	11 E.	A. K. Robinson, Auburn			
Mammoth Bar				Howard Davis, Auburn, et al			R. IX, p. 280; X, p. 417; XII, p. 210; XIII, p. 282.
Marian	35	14 N.	11 E.	Estate of E. A. Hill, Michigan Bluff	3,800	185	R. XV, p. 364.
Mars Cons	31	16 N.	12 E.	Sam Wolford, Grass Valley			
Martin	31	15 N.	10 E.	F. P. Gallaher, Colfax		20	R. XV, p. 382.
Mascot	26	14 N.	10 E.	See Baltimore or Excelsior			R. XV, pp. 357-358; (Excelsior) XVII, p. 449-450.
Masonic	27	15 N.	10 E.	Masonic Mining Co., c/o Alice McIntosh, Roseville			
Maus	36	14 N.	10 E.	W. H. Craig, Forest Hill	3,000		R. XV, p. 364.
Mayflower	22, 23	14 N.	10 E.	Mayflower Gravel Mining Co., Room 1210, 995 Market St., San Francisco	2,700	2,600	R. VIII, p. 467; IX, pp. 29, 120; X, p. 453; XII, pp. 210-211; XIII, p. 283; XV, pp. 94-95; Bull. 92, p. 137.
	24, 25	14 N.	10 E.				
	26	14 N.	10 E.				
McGeachin Placer Gold Mining Co	3, 4	14 N.	10 E.	McGeachin Placer Gold Mining Co., Capital Natl. Bank Bldg., Sacramento	2,500	1,600	Includes Morning Star et al.
	9, 10	14 N.	10 E.				
McManus River							See Burns.

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	Sec.	Twp.	Range				
Missouri	33, 34	14 N.	10 E.		2,650	.....	R. XV, p. 365.
Mohawk	26	15 N.	10 E.	N. E. Booth, Colfax	3,200	.....	R. XV, p. 365.
Monumental	5	15 N.	13 E.	Peter F. Hinst, E. W. Smith and A. A. Bissell, Westville	5,300	200	R. XIII, p. 283; XV, pp. 365-366.
Moody Ridge	3, 10	15 N.	10 E.	Mr. Moody, Pacific Hardware Co., San Francisco	3,650	120	R. VIII, p. 472; IX, p. 29; X, p. 240; XII, p. 211; XIII, p. 283; XV, p. 366.
Morning Star	33, 34	15 N.	10 E.	McGeachin Placer Gold Mining Co., Capital Natl. Bank Bldg., Sacramento	2,700	163	R. VIII, pp. 472-473; IX, p. 29; X, p. 420; XII, p. 211; XIII, p. 283; XV, p. 366; XVIII, p. 45.
Mountain Chief	34	14 N.	11 E.	Fred Outhouse, Forest Hill	.....	.....	R. XV, p. 366.
Mountain Tunnel	4	13 N.	10 E.	A. C. Bequette, Auburn	.....	220	
Mountain Lilly	.....	.....	.....	Estate of P. G. Ekberg, Auburn	.....	.....	
Muir Tunnel Cons	15, 16	14 N.	11 E.	See Forest Hill Mining Corp.	.....	469	
New Baccarat	23	12 N.	6 E.	.....	.....	160	R. XIII, p. 283-284; XV, p. 366.
New Basil Cons	2, 3	15 N.	12 E.	R. F. McLeod, 350 California St., San Francisco	4,900	380	R. XV, p. 368.
	10, 11	15 N.	12 E.				
New York et al	9	14 N.	10 E.	T. L. Schwab, Iowa Hill, et al	.....	64	
North American	28, 29	16 N.	11 E.	L. K. Develey and Brother, Blue Canyon	.....	.....	R. XV, p. 368.
North Bell	22	15 N.	10 E.	E. DeKruse; R. F. Cannon, Iowa Hill	2,500	.....	
North Fork and Bear River, Bear River Tunnel and 1,000 Ft Claim	4, 5	15 N.	10 E.	Estate of Wm. Rablin, 1405 J St., Sacramento; Mrs. Eliz. Uren, Apple River, Ill.; Lewis A. Gould, Fremont Ave., Mountain View and Butte Eng. & Electric Co.	.....	.....	
	33	16 N.	10 E.				
North Star et al	.....	.....	.....	North Star Mining Co., 404 Twenty-eighth St., Oakland	.....	.....	
Occidental	3	14 N.	10 E.	Occidental Mining Co., c/o C. E. Macy, Iowa Hill; J. E. Wretman, Garden City Bank Bldg., San Jose	3,300	171	R. XV, p. 368.
Orion & Rule	32	15 N.	10 E.	Estate of C. F. Macy, Iowa Hill	.....	.....	
Oro	10	14 N.	11 E.	A. Dixon, Michigan Bluff	3,500	.....	R. XIII, p. 284; XV, p. 368.

Oro	14, 23	15 N.	10 E.	Oro and Mountain View Cons. Mining Co., c/o W. H. Russell, Colfax		221	
Outhouse Cons.	24	15 N.	11 E.	Outhouse Cons. Mining Co., Fred Outhouse, Forest Hill, Pres.		960	R. XV, p. 368.
Pacific Blue Lead							See Carmack Placer Mines.
Pacific Gold Gravel	26	15 N.	12 E.	Placer Gold Gravel Co., Michigan Bluff	4,700	160	R. XV, p. 371.
Pacific Slab	27, 28	15 N.	12 E.	Pacific Slab Cons. Mining Co., M. C. Threlkeld,			
	33, 34	15 N.	12 E.	Pres., 1007 Monadnock Bldg., San Francisco		512	R. XV, pp. 346-347; 370-371.
Paragon, Breece & Wheeler	19, 24	14 N.	11 E.	J. F. Thompson, Box 178, Long Beach, or Bath	2,900	500	R. VIII, pp. 467-468; IX, p. 29; X, p. 455; XII, p. 206; XIII, p. 275; XV, pp. 347; 370-371; Bull. 92, pp. 136-137.
	30	14 N.	11 E.				
Park & Brown	21	15 N.	13 E.	C. D. McKinley, Auburn, et al.		160	R. XV, p. 377.
Pear Tree and Necessity	2	13 N.	9 E.	C. M. Langstaff, M. Savage, Forest Hill			
Penn Valley	27	15 N.	10 E.	Mrs. B. F. Jamieson, 415 Third St., San Rafael	3,200	120	R. XV, p. 371.
Pennsylvania	3	14 N.	10 E.	E. E. Freeman, Rose Nicholls, 206 Foxcroft Bldg., San Francisco; J. E. Walsh, Auburn			
J. D. Peter's							See Gold Ring.
Pine Avenue							R. XV, p. 382.
Pioneer Slope	25	14 N.	10 E.	W. H. Craig, Forest Hill			
Placer Queen				Placer Queen Gold Mining Co.	6,230		R. XV, p. 371.
Pleasant Bar	33	14 N.	11 E.	E. Kavanaugh, 40 J St., Sacramento			R. XV, p. 382.
Potato Flatiron							R. XV, p. 383.
Polar Star, Little Bear R. and Southern Cross	34	16 N.	10 E.	Geo. V. Nicholls, 2647 Twenty-fourth St., San Francisco, et al.			R. XV, p. 373.
Polar Star	34, 25	10 N.	10 E.	Wm. Nicholls, Jr., Berkeley	3,100	70	R. XV, p. 379.
Poverty Bar				Charles A. Fowler, 2129 I St., Sacramento			
Protection	34	15 N.	13 E.	Glenn Cons. Mining Co.		100	
		13 N.	12 E.				
Ralston Divide Gravel	15 different sections	14 N.	12 E.	California & Hawaiian Dev. Co., J. S. McCandless, Pres., 858 Mills Bldg., San Francisco	3,500	4,223	R. XV, pp. 371-372; XVII, p. 450-451; Pre. Rep. 8, p. 36.
		13 N.	13 E.				
		14 N.	13 E.				
Red Point							See Golden River.
Red Star				D. M. Ray, Last Chance, and M. Savage			R. XV, p. 372; XXI, p. 280.
Reed	8	15 N.	13 E.	Mr. J. D. Meredith, Capital National Bank Bldg. Sacramento	6,000	150	R. XV, p. 372.
Robinson Flat, Screw Auger				W. S. Edwards			
Rocky Bar	1	14 N.	9 E.	O. L. Estey, Colfax	1,050		R. XV, p. 383.
Rough and Ready	35, 36	14 N.	10 E.	Emma Williams, 3018 Encinal Ave., Alameda; G. H. Garrison, 715 I St., Sacramento, et al.			R. XV, p. 372.

*Due to various legal complications which may arise regarding ownership of unpatented mining claims, we do not vouch for absolute correctness of this column. The names are mostly those appearing on the tax rolls. To save space, frequently only one of several owners is listed.

TABLE OF PLACER MINES AND PROSPECTS, PLACER COUNTY—Continued.

Name of mine	Location			Last owner's or operator's name, address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Sacramento							R. XVIII, p. 263.
Sailor	34	16 N.	13 E.	Sailor Canyon Gravel Mining Co., W. H. Duffy, Supt., San Francisco			R. XIII, p. 285; XV, p. 372.
Sam Laird				Sam Laird, Loomis			R. XIX, pp. 140-141.
Santa Fe				Morgan Green & Co., Auburn		10	R. XV, p. 372.
San Francisco	4	14 N.	10 E.	S. Delmu, Iowa Hill			R. XV, p. 383.
Schlettman				Mrs. J. P. Just, 1209 E St., Sacramento			
Sellier							See Outhouse.
Shackleton							See Shell Mine.
Shaw Brothers'				Estate of Shaw Brothers			R. XIII, p. 285; XV, p. 372.
Shell				Perry and A. V. Shell, Blue Canyon			R. XV, p. 372.
Strawberry	23, 26	15 N.	10 E.	John and Wm. Watts		211	
Winfred Shirley, Willow Bar and American Bar	4, 5	13 N.	11 E.	John A. Britton, 445 Sutter St., San Francisco			
Small Hope	27	14 N.	10 E.	Mr. Federer and James Nicholson, Sacramento		40	R. XII, p. 212; XIII, p. 285; XV, p. 373.
Smyth Ranch				Mrs. Sam Laird, Loomis, et al			
Southern Cross	34, 35	10 N.	10 E.	Geo. V. Nicholls, 2647 Twenty-fourth St., San Francisco	3,000	40	R. XIII, p. 285; XV, p. 373.
Spring Garden	5, 6	13 N.	10 E.	N. W. Nash, Sterling		530	R. XV, p. 373.
	7, 8	13 N.	10 E.				
St. George	33	14 N.	10 E.	A. M. Colwell, Yankee Jim, Mgr.	2,700		R. XIII, p. 286; XV, p. 373.
Star United	27	15 N.	10 E.	H. Gosch, 111 Conway Ave., Grass Valley; Ben Rossi, Iowa Hill, et al.			
Starr	26	15 N.	12 E.	L. C. Hines, Mgr., Westville	4,800		R. XV, p. 373.
Stewart	9	15 N.	10 E.	Stewart Gravel Mining Co., Mrs. G. A. Stewart, Pres., J. D. Stewart, Secy., Auburn	3,000		R. XV, pp. 373-374.
Succor Flat	24, 36	15 N.	10 E.				R. X, pp. 420, 422; XVIII, p. 211.
Swamp Angel	7, 10	16 N.	11 E.	A. W. Hawkins, San Luis Obispo			R. XV, p. 384.
Swift Shore	34, 35	15 N.	11 E.	J. S. Vickford, Michigan Bluff			R. XV, p. 374.
	2, 3	14 N.	11 E.				
Tagpole Cons.	6	15 N.	13 E.	J. L. Sparhawk, Iowa Hill	5,500	280	R. XV, p. 374.
Theniss & Adams	1	14 N.	9 E.	Martin Theniss and P. C. Adams, Colfax	1,200		R. XV, p. 384.

Truro	21, 22	15 N.	10 E.	Truro Placer Mining Co., c/o G. C. Hepburn, Applegate	1,650	106	R. XIII, p. 266; XV, p. 374.
Turkey Hill Consolidated	9, 10	14 N.	11 E.	Turkey Hill Cons. Gravel Co., c/o Wm. Muir & Son, Michigan Bluff			R. X, p. 441; XII, p. 213; XIII, p. 286; XV, p. 374.
	15, 16	15 N.	11 E.				
Twenty-One	3, 10	14 N.	10 E.	O. F. Goodum			
Union	28	15 N.	10 E.	Wm. Hales & Son, Will Hales, 3400 Forty-third St., Sacramento	2,900		R. XV, p. 374.
Unison	35	16 N.	10 E.	J. H. Runckel, Dutch Flat		9	
Veteran	5	15 N.	12 E.	Golden Fleece Gravel Mining Co., 822 Foxcroft Bldg., San Francisco		640	
	3	15 N.	12 E.				
	34	16 N.	12 E.				
Volcano	15	14 N.	11 E.	Wm. Muir, Michigan Bluff			R. XV, p. 374.
Waterhouse							See Big Dipper; X, p. 423; XV, p. 374.
Watts Prospect	26	15 N.	10 E.	John Watts, Colfax			R. XIII, p. 286; XV, p. 374.
Welcome				Est. of T. L. Schwab, Iowa Hill		200	R. XV, p. 375.
Weske							See Turkey Hill Cons., R. X, p. 441; XII, p. 213; XIII, p. 286.
White Pine	27	15 N.	10 E.	Mrs. E. Entwisle, Roseville, et al.			
Wild Yankee				F. K. Develey, Blue Canyon	3,800		R. XIII, p. 286; XV, p. 375.
Willey, Batchelor, Bigelow				Mrs. Mary Dixon, 2322 W St., Sacramento			
Wills	21	14 N.	11 E.	Estate of Mavis Wills, c/o J. A. Wills, Michigan Bluff			
Wisconsin							See Dyer.
Wolverine	27	15 N.	10 E.	E. S. Davis, 615 Twenty-ninth St., Sacramento, et al.		38	
X-Ray				F. Stevens, San Francisco		320	R. XV, p. 375.
Yule & Willey, A. & E., Franklin				Alfred Dixon, 2322 W St., Sacramento			
Zelma Bell	19	14 N.	10 E.	Zelma Bell Mining Co.		40	R. XV, p. 384.

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GRANITE.

Granodiorite, locally called granite, is the principal rock outcropping in the district between Rocklin and Newcastle. Quarries were opened at Penryn by G. Griffith and at Rocklin in 1863 and 1864 immediately after the completion of the Central Pacific Railroad to those points. Many of the finest buildings in the state, including the state capitol and a number in old San Francisco, were built with the Placer County stone. The industry at these two towns employed 300 men or more until 1890, when the demands of stonecutters for increased wages and the competition of manufactured building materials strangled it.

There are several grades of stone in the different quarries. That from Rocklin is a rather fine-grained biotite granite with considerable orthoclase, and the dark minerals are not prominent, so that the color is silver gray. At Penryn the stone in the main quarry is formed of much coarser crystals and biotite and hornblende are prominent. That at Loomis is intermediate in character between the two. A mile east of Penryn, a small quarry was opened on an outcrop of gabbro, a black medium-grained stone used for small work. All of these stones take a high polish. There is an abundance of granite more remote than the above quarries, and small workings have been opened at several places near Lincoln, Loomis and elsewhere. Granodiorite also occurs in the extreme northern part of the county in the vicinity of Emigrant Gap. Elsewhere than named above, the outcrops of this stone in the county are too remote from the railroad to be commercially available.

Most of the quarry workings were in pits, which in several cases have reached a depth of 100 feet. The stone is for the most part remarkably straight grained. It was broken out with plugs and feathers and hoisted from the pits with derricks operated by steam. Polishing works using steam power were operated at Penryn and Rocklin. Stone was supplied for a great variety of uses, including buildings, cemetery work, curbing, railroad culverts and rip-rap. The last large order for building stone was filled in 1920 by California Granite Company, which supplied stone from its Rocklin quarry for the Bank of Italy Building, San Francisco. The business has dwindled until at present only a few men are employed at Rocklin in getting out an occasional small order, and none of the other quarries have been active for years. The Rocklin and Penryn quarries were served by spur tracks from the main Central Pacific line.

Adolph Pernu and Sons work the quarry formerly operated by California Granite Company. It is in the town of Rocklin. During the past two years only a small amount of monumental stone has been quarried. The property is supplied with electric power and compressed air.

Oscar Anderson has a quarry in the town of Rocklin from which he fills occasional orders for rip-rap, curbing, etc. Part of this work is sometimes sublet to other quarrymen.

None of the other quarries have been active the past two years. In all, 27 quarries at Rocklin were listed in the Fifteenth Report of the State Mineralogist, 1915. Most of them employed only two to four men each.

Griffith Quarry at Penryn has been idle practically ever since 1890, when its founder, G. Griffith, died. The buildings and equipment are falling in ruins.

IRON.

Hotaling Iron Mine. John Barnicott, Newcastle, owner. It is 3½ miles west of Clipper Gap by road, in Sec. 15, T. 13 N., R. 8 E.

The deposit consisted of magnetite and hematite lenses at the contact of granodiorite, diabase and Carboniferous limestone and slate. It was found in 1866 and was worked until 1885, but principally between 1880 and 1885. The ore contained from 40% to 65% iron.

High-grade hematite was mined from No. 1 shaft and open cut. This orebody was 250 feet deep, 30 feet wide and 100 to 150 feet long, and was 100 yards south of the old furnace site. It is reported worked out. No. 2 shaft was in magnetite of lower grade. It was 150 feet deep and an orebody 50 feet wide by 150 feet long was mined. The high-grade hematite from No. 1 was mixed with the lower grade magnetite from No. 2 to give furnace feed containing an average of 55% iron. The stopes were timbered with square sets. No. 4 shaft was 100 feet deep and produced some iron.

According to J. Richards, who was superintendent of the property during the principal operations, the blast furnace was operated steadily between 1880 and 1885, except for three months time lost in rebuilding it after a fire. Oak wood was cut from 25,000 acres of land in the vicinity for charcoal. Limestone was mined on the property. From 30 to 35 tons of fine quality pig iron was produced daily. It was used by the Southern Pacific Company for car wheels and axles, and by other coast industries. Competition from Alabama iron and depletion of the high-grade ore, hastened closing. Considerable lower grade ore is believed to remain.

Other properties in the district nearby furnished small tonnages of low or medium-grade ore, which was hauled to the Hotaling furnace and mixed with the high-grade hematite for smelting.

Iron ore croppings occur in Sec. 21, T. 14, N., R. 9 E., near Weimar, and were prospected many years ago by Phoenix Iron and Lime Company.

LIMESTONE.

A series of deposits of limestone of good grade occur at intervals, from Middle Fork of American River, five miles east of Auburn, northward. A small body of white granular limestone at the old Hotaling iron mine, 3½ miles west of Clipper Gap, was used for flux during the smelting operations. Another deposit, 2½ miles south of west of Clipper Gap on the South Fork of Dry Creek, and one on the east side of the town of Auburn, have also been worked. Another series of limestone lenses outcrop at intervals from the Middle Fork of American River in the vicinity of Mammoth Bar, seven miles east of Auburn, to the vicinity of Applegate. Most of these are too small for cement plants, but some have supplied lime for other purposes. There are two large deposits in the canyon of American River, one five miles from Auburn on the Forest Hill road on the Middle Fork, and the other below Gorge station on the North Fork. Other deposits in the more remote parts of the county are too far from the railroad to be commercially valuable now.

De Witt Deposit. Owner, Mrs. Eleanor De Witt, 1931 C street, Sacramento, California. This is a small deposit of good quality limestone, 1¼ miles by road south of Clipper Gap.

Dunlap Deposit. Owner, Boutwell Dunlap, Auburn, California. A large lens of gray limestone, outcropping for a mile in length, has been traversed by the Middle Fork of American River. The southern portion, in El Dorado County, has supplied an immense tonnage for cement manufacture, having been operated for many years by Pacific Portland Cement Company. The Dunlap property is the part in Placer County which is crossed by the Forest Hill road five miles from Auburn. The outcrop rises to a height of nearly 500 feet above the river level, is one-third mile long and several hundred feet wide. No work has been done upon it.

Vic Mathews, Lincoln, has offered for sale a deposit of limestone six miles from the railroad.

E. Petterson, Box 46, R. F. D., Lincoln, California, has a deposit of good grade limestone on the main line of the Southern Pacific one mile from Auburn. The deposit outcrops for a length of about 1000 feet and width of 100 feet. Some of it has been burned for lime.

Spreckels Deposit. Owner, Spreckels Sugar Company, Spreckels, California. Contains one patented mineral claim, a millsite and other land adjoining, 102 acres in all, in Secs. 8 and 9, T. 13 N., R. 9 E., one mile by road from Applegate station.

The deposit is of fine-grained, bluish-grey limestone of good quality. It is from 100 to 200 feet wide, 20 to over 100 feet deep and 650 feet long, according to logs of drill holes, some of which showed serpentine and slate interbedded with the limestone. It lies below the surface and would have to be worked by a pit. The last operations were by the owners in 1916.

Sullivan and Linder Deposit. Owners, D. J. Sullivan, Alta, and Mrs. R. E. Linder, 2022 Brush street, Oakland.

This is a large, undeveloped deposit in the canyon of North Fork of American River below Gorge station, on the road to the Rawhide Mine. Probably one-half mile of tramway would be required to deliver the limestone to the railroad.

MAGNESITE.

Small magnesite prospects occur near Damascus, Michigan Bluff, Gold Run and north and south of Towle. A little work was done 11 years ago and one property was a small producer in 1916 and 1917, since which time all these prospects have been idle. The following brief notes are extracts from our Bulletin 79, "Magnesite in California," 1925, pp. 59–60, and from our Report XV, 1915, pp. 391–392.

Little Bear prospect is in SE¼ Sec. 35, T. 16 N., R. 10 E., above Alta power house. A 2½-foot vein was exposed, but not enough ore was found to make a shipment.

Placer County Properties Company's claims of 400 acres were in Sec. 13, T. 15 N., R. 10 E., and Secs. 7 and 18, T. 15 N., R. 11 E., five to six

miles northeast of Iowa Hill. The Colfax-Iowa Hill road, now being rebuilt in part (1927), will give a haul of 13 to 14 miles from these claims to Colfax if grades are reduced enough to permit trucking. Otherwise there would be a 30-mile haul via Foresthill.

Small magnesite outcrops occur, and a stockwerk of magnesite veins up to eight inches wide was cut in an old adit.

Sullivan Claim is on 80 acres in N½, Sec. 19, T. 16 N., R. 11 E., four miles by road from Alta. A 4-foot vein was followed for 50 feet in an adit, where it broke into narrower veins. An incline was also run 70 feet on stringers of magnesite. Forty tons of magnesite were shipped in 1916, and a little in 1917. D. J. Sullivan, Towle, and others, owners.

Outcrops of magnesite, undeveloped, are reported in Sec. 6, T. 15 N., R. 11 E., north of Towle, and in Secs. 24 and 36, T. 16 N., R. 10 E., south of Towle.

MANGANESE.

Some prospects of manganese oxide were opened in 1917–18 nine miles from Colfax, adjacent to the road leading to Yankee Jim's and Forest Hill, in Secs. 20 and 29, T. 14 N., R. 10 E.

The ore occurred near the surface as black oxides in quartz lenses striking N. 50° W. At a depth of only a few feet the ore began to show rhodonite, which was increasing with depth. The country rock is of the Calaveras formation.

Gray Lease was on land belonging to the Central Pacific Railway Company in Sec. 29, T. 14 N., R. 10 E. The showing of manganese ore here was only slightly prospected.

Tilsey & Coplen group of four unpatented claims were located in January, 1918, in Sec. 20, T. 14 N., R. 10 E., and were worked in a small way during that year. About two carloads of black manganese oxide ore was mined. Idle since 1918.

Bibl: Calif. State Min. Bur. Bull. 76, pp. 52–53.

D. W. Lee of Yankee Jim's has a manganese oxide prospect near that place.

MARBLE.

Holmes Lime and Cement Company, 2 Pine street, San Francisco, owner. Dark gray marble with jet black and white veining occurs on property owned by this company in the NW¼ of NW¼ of Sec. 4, T. 14 N., R. 9 E., 3½ miles west of Colfax, on the south bank of Bear River. There is a good road to a point on the hill 1000 feet from the quarry, from which point a tramway, now in ruins, extended down the steep slope to the workings.

A face 40 feet high by 400 feet long has been opened. Some of the marble was sawed and used in the early days in the United States Mint and Bank of California in San Francisco, and in other buildings. Later the stone was burned to make lime, but the quarry has been idle for ten years, and the two old circular iron kilns are in poor condition.

MINERAL PAINT AND FILLER.

Low-grade iron oxide in the form of red and yellow ocher has been shipped from the *Bancroft Ranch* and other properties in the vicinity

of the Hotaling Iron Mine, in the Clipper Gap district. There has been no production for two years past. This oxide was used for paint.

Some low-grade yellow ocher or iron-stained shale has been shipped from the *Everhart Brothers* property, two miles from Gold Run. While the exact use to which it was put is not known, it is believed to have been used for filler, mortar color or some similar purpose. There has been no production for three or four years.

Some dark reddish-brown ocher, evidently decomposed iron oxide sand, was shipped in 1924 from the vicinity of Sugar Pine mill, nearly 25 miles by road from Colfax via Forest Hill. It was reported to have been used for paint.

PLATINUM GROUP METALS.

These metals have been recovered as a by-product of gold dredging on the forks of American River. Two dredgers were operated on the Middle Fork, one near Mammoth Bar and the other about three miles farther upstream, between 1914 and 1918. From 1918 until the middle of 1927 one of these was operated on the North Fork, beginning three miles above the junction with the Middle Fork. The production of the above metals compared favorably with that from other districts, but amounted in all to only a few ounces a year, as the yardage handled here was relatively small. The assay of the product showed a content of iridium about equal to that of platinum, with traces of palladium and rhodium.

Although the American River drains large areas of serpentine and allied rocks, from which rocks the platinum group metals have no doubt been derived, there have never been any discoveries of these metals in place in the county. The most interesting belt of serpentine and peridotite extends from the Middle Fork of American River at Volcano Canyon, southeast of Forest Hill in a northerly direction through Towle to Bear River, being covered at intervals by the later andesite.

Bibl: Cal. State Min. Bur. Bull. 85, pp. 29–30.

ROCK, SAND AND GRAVEL.

Enwood Sand and Rock Company's plant is just east of Roseville on the state highway and is served by spur track from Southern Pacific railroad. Scott F. Ennis and Edward S. Brown, owners, Sacramento.

Sand and gravel are taken from Secret Ravine. The sand is coarser than that from many pits and is preferred for certain uses. Digging is done with a P. & H. drag-line outfit, and the material is hauled over a narrow-gauge railroad in 3-yard side-dump cars by gasoline locomotive to a 24-inch belt conveyor, which raises it to the top of the plant. The first or scalping screen separates the sand and fine gravel up to a 2-inch size. Sand is washed after passing this screen. Coarse rock passes to primary and secondary crushers and is again elevated, screened through two conical screens and the various sizes of crushed rock are distributed to separate bunkers. From these, the rock is drawn to a 20-inch mixing belt for loading in railroad cars or truck bins or for delivering to

another conveyor which takes it to the outside stock piles. A clam-shell bucket is used to load cars from the stock piles.

A little gold is recovered when the sand is washed.

J. A. Robles, Applegate, has a large deposit of silica sand along Bear River, 4½ miles by road west of Applegate. The deposit is about 200 feet wide and up to 7 feet deep, occurring in bars at intervals along the river for two miles. So far, it has been used only locally for concrete.

The granite quarries at Rocklin are in a position to supply rock in large sizes for riprap, breakwaters, railroad fills and the like. Contracts for such rock are filled occasionally.

Mariposite suitable for roofing rock or stucco dash occurs at the Four Aces quartz mine in Volcano Canyon, three miles from Forest Hill and 18 miles by road from Colfax, the nearest railroad point.

SILICA (VEIN QUARTZ, COBBLES, SAND).

A wide ledge of pure white quartz outcrops on the *Davenport* property in the canyon of American River about one mile from Auburn (Railroad St. station). It could be cheaply mined because of its width and the slope of the hill. It adjoins the Pacific Portland Cement Company's private railroad from Mountain Quarries to Flint, on the Southern Pacific west-bound main line a mile west of Auburn, but this private road is said to not be a common carrier. M. E. Davenport, Auburn, owner.

Quartz cobbles have been shipped from Gorge by *Dan Sullivan,* Alta. They were gathered from the bedrock of an ancient channel, where they were left after hydraulicking.

Quartz cobbles and boulders have also been shipped for many years from the *Polar Star* hydraulic mine and other claims at Dutch Flat. W. P. Nicholls, Jr., Berkeley, owner. Both of these localities are within a short distance of the railroad and the quartz was loaded and delivered to the cars at a very low cost, as there was practically no mining expense involved, except the occasional breaking of a large boulder. Most of the recent sales have been to rolling mills and for use in making fire brick.

Silica sand has been prospected in Sec. 8, T. 11 N., R. 7 E., between Rocklin and Loomis and between the two lines of the Southern Pacific; also in Secs. 9 and 10, T. 12 N., R. 6 E., adjacent to Gladding, McBean and Company's works.

SOAPSTONE AND TALC.

Wall Property. Owners, Wall heirs, care Wall Brothers, Gold Run. Leased to K. W. Keasbey, Colfax. It is on patented land in the NE¼ Sec. 23, T. 15 N., R. 9 E., 3½ miles north of Colfax, adjacent to the You Bet road.

The deposit is a large upright lens of talc and block soapstone on a ridge above the road. It was worked quite extensively over 30 years ago by open pit. Selected blocks were lowered down the 45° slope on a cable car and sawed to size for engine fire bricks and similar uses. The largest pit was 200 feet long by 50 feet wide by 30 feet deep, showing soap-

stone and talc the entire distance; it was proven at least 200 feet farther on the strike and is 10 to 20 feet wide. The dip is vertical. The material is soft and without grit. Most of that exposed in the open pit is slightly iron stained. There is reported to be a workable vein of high quality white-grinding talc in an old tunnel, which was inaccessible at the time of visit. Keasbey has been doing some prospecting to develop this.

An analysis of the talc by Abbot A. Hanks follows:

Silica	60.04%
Ferrous oxide	3.48
Aluminum oxide	1.14
Magnesium oxide	28.89
Calcium oxide	0.00
Ignition loss	4.3
Undetermined	2.15
	100.00%

ZINC.

Zinc has never been produced commercially in the county, but under favorable conditions may be at some time in the future.

Valley View Mine, six miles northeast of Lincoln in SE¼ Sec. 13, and NE¼ Sec. 24, T. 13 N., R. 6 E., was originally worked as a gold mine, but later developed into a copper property. Three shafts, 130, 180 and 280 feet deep, have been sunk on the property. Zinc sulphide occurs in association with the copper sulphide in some of the ore. Judge J. B. Landis and Ed. Gaylord, Auburn, are the owners.

The present price of zinc hardly warrants the hope of making zinc producers of the small, high-cost California mines, though this may occur whenever the price improves and the metallurgical art advances to the point where a clean zinc sulphide concentrate can be made from Californian ores at reasonable cost. The only large zinc producer in the state, in Shasta County, has closed down during August, 1927, because unable at present to make a profit.

ZIRCONIUM.

Zirconium, in the form of zircon, the silicate, occurs in small amount as a primary constituent of the granodiorite which forms so large a part of the country rock east of the Sacramento Valley. In places where sand has accumulated from erosion of the granodiorite, zircon is found as part of the heavy concentrate. So far as known, no real work has been done to determine the feasibility of recovering it.

LOS ANGELES FIELD DIVISION.

W. Burling Tucker, Mining Engineer.

LOS ANGELES COUNTY.

Los Angeles County is bounded on the north by Kern County, on the east by San Bernardino County, on the south by Orange County, on the west by Ventura County and the Pacific Ocean.

The ocean shore line extends for about ninety miles. The county comprises four thousand and sixty-seven square miles, or about three million five hundred and eighty-four thousand acres, a large proportion of which is mountainous.

Physiography.

The chief topographic features of this county are the mountain ranges, the valleys and the great Los Angeles Plain which stretches from the foothills to the sea.

The principal mountain range is the San Gabriel, which extends with a northwest trend 45 miles from Cajon Pass to Soledad Canyon. The two principal peaks of this range are Mount Lowe (elevation 5650 feet) and Mount Wilson (elevation 5700 feet). The latter is the site of an astronomical observatory. The other prominent peaks of this range are Mount San Gabriel, elevation 6152 feet, and Mount Markham, elevation 5760 feet. The main portion of this range lies north of San Gabriel River, and contains all the highest peaks of the range, as Mount San Antonio (Old Baldy), elevation 10,080 feet and about 4 miles west of Mount San Antonio, Iron Mountain, 7517 feet high. About 6 miles southwest is Mount Gleason, elevation 6503, and about 20 miles northwest is North Baldy, 9389 feet high. Other ranges in the county are the Santa Susana and Santa Monica. The former, which is a continuation of the San Gabriel Range, lies north of San Fernando Valley, and the Santa Monica Range flanks the coast, extending from the ocean in Ventura County eastward to the Los Angeles River. The San Gabriel Range is chiefly formed of crystalline rocks, with its central axis consisting of granite, with gneisses and schists on its flanks. The Santa Susana and Santa Monica ranges are chiefly formed of Tertiary sedimentary rocks.

Los Angeles County has two principal rivers, San Gabriel and the Los Angeles. San Gabriel River takes its source in the San Gabriel Range and flows southwest, reaching the ocean through Alamitos Bay. Los Angeles River rises in the Santa Monica Mountains near the Ventura County line and, flowing thence through San Fernando Valley, east and south, unites near Compton with the Rio Hondo, its waters emptying into Long Beach Harbor.

Mineral Resources.

There is only a small production of metals in Los Angeles County, its principal wealth being in structural and industrial materials, petroleum and natural gas.

The production of petroleum for the year 1926 amounted to 105,826,337 barrels, valued at $174,084,324, while the production of natural gas was 91,054,793 M cu. ft., valued at $8,965,307.

Among its mineral resources may be noted asphalt, barytes, borax, brick, clay, copper, fuller's earth, gems, gold, gypsum, infusorial earth, lead, limestone, marble, mineral paint, mineral water, natural gas, petroleum, glass sand, sandstone, serpentine, silver, soapstone, miscellaneous stone and zinc.

METALS.

ANTIMONY.

This metal occurs associated with complex sulphide ores carrying copper, cobalt, nickel, lead and zinc in Pacoima Canyon, on the claims formerly held by the Denver Mining and Milling Company, of San Fernando. It occurs as stibnite, antimony sulphide. It is also reported to occur near Lancaster.

Bibl: State Mineralogist's Report XVII, p. 318; State Mining Bureau Bull. 38, p. 359.

CHROMITE.

Chromic iron ore occurs as float in the vicinity of Acton, Bouquet Canyon and Harold, a station on the Southern Pacific Railroad.

Acton Chromite Deposit is located in T. 5 N., R. 13 W., S. B. M., not far from the railroad station at Acton. The occurrence is not of commercial importance.

Bibl: State Mineralogist's Report XV, p. 471.

Bouquet Canyon Deposits. Considerable high grade chromite has been found over the surface near the summit of the ridge north of Bouquet Canyon, 13 miles north of Saugus, a station on the Southern Pacific Railroad.

The chromite is found as float, varying in size from two inches in diameter to large boulders of 100 pounds in weight in a zone of serpentized peridotite, that strikes northeast. The harder serpentine contains a small amount of chromite disseminated through it. To date no lens of ore has been found in place. The ore is reported to carry 42% Cr_2O_3. A number of claims were located along the serpentine belt during 1918 and considerable prospecting was done in this area, but no commercial tonnage was developed.

Evert Chromite Deposit. The deposit is located one mile west of Harold, a station on the Southern Pacific Railroad.

Bibl: State Mineralogist's Report XV, p. 471.

COBALT.

Occurrence of cobalt has been noted in several localities in Los Angeles County, but to date no commercial production has resulted. It occurs in Pacoima Canyon in deposits of complex ores, carrying antimony, copper, nickel, lead and zinc; also in the Kelsey mine (see under Lead-Silver), in the Silver Mountain District.

COPPER.

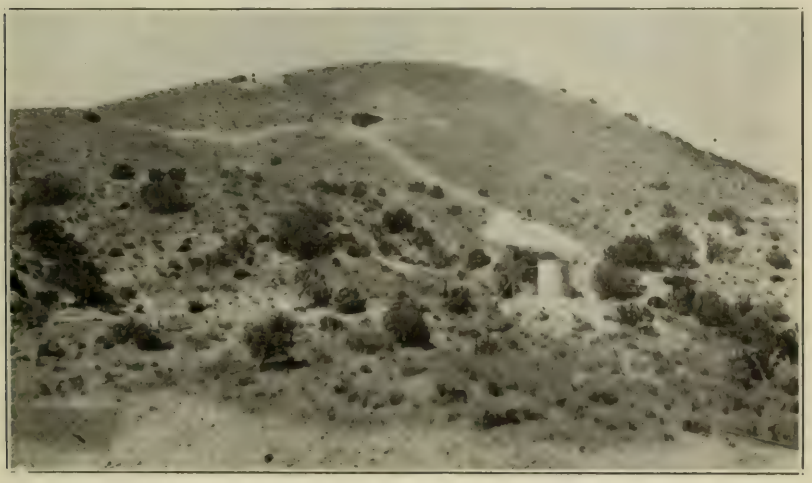
There are no producing copper mines in the county, but copper ores occur near Acton, at Black Mountain, east of Palmdale and on Santa

Year	Gold	Silver	Petroleum		Asphalt (tons)	Natural gas (M cu. ft.)	Gypsum		Salt		Gems, Value	Mineral water		Brick		Pottery clay		Sandstone and serpentine		Miscellaneous stone, Value	Miscellaneous and unapportioned		
			Barrels	Value			Tons	Value	Tons	Value		Gallons	Value	M	Value	Tons	Value	Cubic feet	Value		Amount	Value	Substance
1880	$7,700	$66,300	*																				
1881	12,000	39,000																					
1882	17,000	24,000																					
1883	20,000	22,000																					
1884	40,000	11,000																					
1885	22,500	1,045																					
1886	21,500	6,750																					
1887	25,000	25,000																					
1888	20,000	10,000																					
1889	38,393	97																					
1890	74,120	7,266																					
1891	40,239																						
1892	219,284																						
1893	14,200																						
1894	34,500		476,859	$617,985			1,134	$11,340						7,500	$37,500						$5,500	9,000 bbls.	$10,800	Lime.
1895	23,120		979,695	732,817			3,790	37,820						45,800	225,000						47,500			
1896	35,468		953,734	812,800			950	9,189						27,518	170,290						30,000			
1897	40,695		1,327,911	1,327,911			1,900	17,250						36,868	228,200			[1,500	$6,000		30,625	5 tons	200	Industrial earth.
																		[2,500	2,500					
1898	21,300		1,462,871	1,462,871			2,500	18,500						26,908	188,356	50	$500	10,000	5,250		32,500	2 tons	50	Sulphur.
																		750	3,000					
1899	13,132		1,409,356	1,409,356	[1,151	$23,020	3,563	14,250				193,300	$5,805	23,285	147,400			[5,000	2,000		112,901	1,500 cu. ft.	2,000	Marble.
1900	5,508		1,722,887	1,722,887	[5,000	100,000	2,500	10,000						55,725	276,925	4,576	10,776	[7,300	3,750		24,252			
																		350	2,000					
1901	10,312		2,304,432	1,062,038	[10,000	[$1,500	3,500	35,500	9,650	$19,950				44,435	264,825	130	200	[89	50		94,229	10 tons	19	Soapstone.
						152,838																		
1902	7,599		2,198,496	1,078,868	[16,767	171,604			90	180				52,776	335,670	890	890				105,047	160 tons	300	Mineral paint.
																						14,400 lbs.	504	Lead.
																						60 tons	360	Industrial earth.
1903	8,674	22	1,960,604	1,204,866	[28,308	332,600	5,914	38,441	8,000	20,000		95,000	5,500	79,166	706,334	115	115	[2,163	9,734		118,185	1,726 tons	2,588	Glass sand.
																						210 tons	10,174	Soapstone.
																						10,000 bbls.	10,000	Lime.
1904	12,402	73	2,190,000	1,239,910	[30,425	307,068			7,560	24,480		125,750	7,084	128,719	767,827	5,000	5,000	[29,211	13,145		83,826	700 tons	4,254	Glass sand.
																		[200	2,310			228 tons	2,375	Soapstone.
1905	15,035	100	2,854,504	1,056,188	[23,718	119,430	11,500	43,500	12,000	20,000		175,000	31,250	109,563	853,910	30,333	10,666	[8,784	9,959		69,021			
1906			2,814,000	908,800	[25,920	259,200	21,000	69,000	12,000	36,000		85,465	5,128	127,965	826,831	41,350	34,355	[10,080	9,540		176,538	18,000 bbls.	18,000	Lime.
																		[847	1,694			50 tons	200	Industrial earth.
																						849 lbs.	169	Copper.
1907			4,318,739	2,633,541	[26,810	353,423	7,500	50,000	12,000	36,000		385,000	35,100	101,079	895,573	17,500	20,300	[21,186	19,078		36,904	1,600 cu. ft.	3,000	Marble.
																		[1,000	2,000			25,000 bbls.	25,000	Lime.
1908			6,244,347	4,082,052	[25,000	259,000	12,000	75,000	12,000	48,000	$8,500	573,975	42,857	108,414	800,163	25,934	35,574	[6,292	2,000		508,618	300 tons	8,000	Glass sand.
																						1,800 tons	14,400	Glass sand.
1909	804	2	5,409,332	3,513,192	[40,740	516,500	10,000	50,000	10,000	30,000	9,500	266,315	19,988	136,202	1,195,892	14,027	20,698				182,377	2,600 cu. ft.	6,000	Marble.
																							642,530	Unapportioned, 1900-1909.
																						40 tons	320	Industrial earth.
																						60 tons	720	Feldspar.
1910			6,127,206	3,183,433	[45,872	591,163			6,000	12,000	4,900	319,491	23,999	148,723	1,361,653	450	800				324,091	80 tons	200	Glass sand.
					[30,920	16,208																4,800	4,800	Marble.
1911	*		4,924,288	3,313,972		[15,208			7,592	16,113	5,000	229,019	17,256	160,259	1,442,013	15,650	41,025				553,076	1,100 cu. ft.	3,300	Marble.
1912	*		4,484,259	2,738,384		[28,672			10,350	46,370	3,000	76,495	5,333	174,862	1,692,258	11,929	12,038				935,908	1,800 tons	1,800	Glass sand.
																							2,900	Glass sand.
1913	2,322	27	4,183,609	2,672,680	[1,287,794	77,578			10,000	40,000	2,500	255,095	15,140	204,912	1,752,106	7,425	20,135				1,008,810		240,000	Other minerals.
1914			2,558,890	1,957,279	[1,250,000	75,000			20,000	80,000	2,100	331,151	8,025	133,557	1,244,871	8,243	14,566				953,434	19,203 tons	349,669	Borax.
																						10 tons	100	Potash.
1915			2,931,998	1,843,661	[1,720,025	120,783					700	350,171	29,401	88,609	820,312	6,567	1,511				1,022,134		330,720	Barite, borax, potash.
1916			2,878,468	1,871,930	[2,083,664	139,572			*		600	320,709	8,552	82,005	760,912	6,233	10,549				971,153	1,864 tons	324,789	Potash.
																						612 tons	1,684	Silica.
																							373,474	Borax, copper, graphite, salt.
1917			4,669,583	5,491,430	[1,670,476	194,793			*		300	188,368	16,902	and tile	939,081	6,276	10,321	*			608,929	1,710 tons	400,992	Potash.
																							562,758	Borax, graphite, magnesium chloride, salt cake, serpentine, talc.
1918			10,125,190	13,557,755	[2,088,959	224,279			*		*	110,481	15,540	43,381	608,576	12,634	11,820	*			517,190	18,030 tons	121,963	Building tile.
																						2,380 tons	262,680	Potash.
1919			10,076,633	20,805,754	[4,148,476	458,812			*		*	125,409	8,787	and tile	1,185,154	11,329	23,343				715,524		399,067	Borax, gems, graphite, magnesium salts, serpentine, salt.
1920		*	14,026,536	21,488,653	[6,225,835	556,465			6,592	6,577		161,466	10,371	127,851	2,333,941	18,984	91,762				1,701,951	27,054 tons	308,476	Building tile.
																							473,989	Borax, copper, gold, graphite, industrial earth, lead, magnesium salts, silver.
1921		*	12,305,605	25,795,254	[6,944,277	638,035			*		*	284,468	17,314	and tile	3,208,448	29,055	62,869				1,703,180		222,043	Borax, gems, gold, graphite, limestone, magnesium chloride, salt, silver.
1922		*	37,726,367	52,930,093	[23,254,849	1,653,571			*			300,400	10,450	240,424	4,199,495	54,924	66,519				2,390,477	39,095 tons	397,126	Building tile.
																						12,600 tons	25,168	Limestone.
																							72,772	Borax, gold, graphite, magnesium salts, salt, silver.
																							40,000	Building stone.
1923	714	6	158,665,019	154,063,733	[124,799,452	8,760,961			*			440,563	24,787	310,807	5,307,988	128,825	39,272				5,408,803	53,199 tons	522,990	Building tile.
																						2,717 tons	3,577	Limestone marl.
																							169,641	Borates, diatomaceous earth, magnesium chloride, salt, shale, soapstone.
1924	731	5.515	119,027,428	147,474,953	[122,838,521	9,191,705			*			1,889,285	88,942	301,957	5,030,259	84,065	132,855				5,923,329	46,941 tons	454,728	Building tile (hollow).
																							117,982	Copper, building stone (tuff), diatomaceous earth, lead, limestone, magnesium chloride, salt.
1925	409	15.444	121,214,551	173,215,503	[98,226,700	8,704,894			*			3,811,270	336,038	196,955	3,399,748	217,767	196,817				6,978,605	44,345 tons	426,178	Building tile (hollow).
																							95,274	Copper, lead, limestone, magnesium chloride, salt, sandstone, zinc.
1926	94	42.638	105,826,337	174,684,324	[91,054,793	8,965,307			*			4,026,495	290,459	238,326	2,951,067	86,747	90,076	—	—		7,472,854	21,471 tons	152,488	Building tile (hollow).
																						1,104,362 lbs.	88,361	Lead.
																						2,504,188 lbs.	192,824	Zinc.
																							66,974	Building stone (tuff), limestone (marl), salt.
Totals																							$8,703,524	
	$4800,108	$2380,199	665,424,117	$831,562,143		$43,050,060	$7,761	$479,781	$140,754	$406,670	$45,200	10,467,983	1092,0:8		$40,122,307	$46,828	$ 45,715		$99,030		$17,988,838			

*Commercial production of petrolrum in Los Angeles began at least as early as 1874, in the Newhall district, but detailed county segregations are not available for the early years.
† Includes granite, crushed rock, rubble, paving blocks, sand, gravel.
‡ Asphalt, long.
§ Natural gas, thousand cubic feet.
♦ Included in Riverside County production.
* Included in Monterey County production.
* Sandstone.
* Serpentine.
*See under "Unapportioned."

Catalina Island. Copper also occurs as chalcopyrite in the complex ores of Pacoima Canyon. Exploration and development on the deposits near Acton were attempted in 1889 and the Black Mountain deposits were prospected in 1908, but no commercial production was made. The only active development in recent years is on the deposits located near Acton, which was started in 1926, by Allen Mines Company, of Los Angeles.

Black Mountain Deposits. These deposits are located 27 miles southeast of Lancaster on Black Mountain. The ore occurs as malachite and carries values in gold and silver. There is a series of parallel veins in gneiss that strike northwest. Widths vary from 12 inches to 2 feet. A number of shafts have been sunk on the different vein showings to depths of 10 to 15 feet. The ore is reported to carry from 2% to 7% copper with from $3 to $7 in gold and silver. Eight claims are owned by J. L. Watts, of Lancaster, California.



Surface workings of copper veins, Parker Mountain Mine, Acton, California.

A copper deposit formerly worked by the Palm Development Company in 1908 is located in Sec. 30, T. 5 N., R. 10 W., S. B. B. and M., 12 miles southeast of Palmdale. The ore occurred in a porphyritic dike, which averaged 180 feet in width. The dike is mineralized with malachite and carries values in gold and silver.

Bibl: State Mineralogist's Report XV, p. 471.

Denver Mining and Milling Company. W. S. McGrew, W. B. Folger, National Bank Building, San Fernando, California, own a group of claims known as Denver, Chance, Fenner, Indicator and Red Ledge, 12 miles northeast of San Fernando, in Pacoima Canyon. Elevation 2610 feet.

There is a series of parallel quartz veins that occur in schist and gneiss and strike N. 80° E. and dip 60 to 80° south. The veins vary in width from 2 to 4 feet, with the exception of the Red Ledge vein which in places is 20 to 50 feet wide. The ore is a complex sulphide, carrying

massive pyrrhotite, chalcopyrite, galena and sphalerite and stated to carry traces of nickel, cobalt and antimony.

These sulphides occur in lenticular masses in the different quartz veins. Development consists of a number of shafts and tunnels on the different veins. Idle.

Bibl: State Mineralogist's Report XVII, p. 318.

King of West Mine. It is located one mile south of Acton, just north of Southern Pacific Railroad tracks. Holdings comprise 80 acres of patented land. Owner, R. E. Nickel, of Acton, California.

A vein of quartz 4 feet in width occurs in granite. It strikes north and has a vertical dip. The quartz is mineralized with malachite, bornite and carries values in gold and silver.

Development consists of a shaft sunk on the vein to a vertical depth of 150 feet and a number of other shallow shafts. Idle.

Parker Mountain Mine. (Emma Group of Mines.) The property comprises 100 acres of patented land and 5 claims held by location, located 2 miles south of Acton. Owner, Highland Mining Syndicate, William B. Conover, agent, Bradbury Building, Los Angeles. Under option to Allen Mines Company—Walter B. Allen, president; R. E. Ashworth, secretary; E. D. Foster, general manager.

In 1889 this group of copper claims was worked by the Emma Consolidated Mining Company. The present company started operations in 1926 and is planning to leach the ore for the recovery of its copper content. Elevation 2200–2900 feet.

The deposit consists of a series of parallel veins that strike northeast and dip slightly to the east, containing copper in quartz. There is also a series of parallel quartz veins that strike east and dip north about 50° that cross the northeast veins. The different veins vary in width from 3 to 20 feet. The country rock is granite. In the neighborhood of these veins there are a number of diorite intrusions which strike east and dip south. The ore is copper carbonates, bornite and chalcopyrite, in quartz gangue. The average value is stated to be 2% copper with values in silver and gold of $1.20 per ton. The veins that have been developed to any extent are known as the Emma, Bullion, Pacific and London.

Development: The Emma vein has an average width of four feet and strikes northeast. A shaft has been sunk to a depth of 75 feet and at an elevation of 2800 feet a crosscut tunnel has been driven in the granite N. 60° W., 458 feet, to intersect the vein. The present development work is confined to this vein, where at an elevation of 2900 feet, an opencut has been made on the vein on the south slope of the hill. About 50 feet above this opencut is a diorite dike 20 feet in width that strikes east and dips south. The ore is being mined from this opencut by means of a dragline scraper, which delivers it to ore pocket, from which it is trammed over incline tram in cars having a capacity of 2 tons, to stock pile for leaching. The ground storage capacity of stock pile is stated to be three-quarters of a million tons. The ore is reported to have an average value of 1% copper. The ore is to be heap leached with a 2% H_2SO_4 solution. Solution from ore pile flows through wooden troughs to 7000-gallon settling tank. Overflow from settling tank goes to seven precipitation launders where air is used for agitation.

It is stated that the plant will recover one ton of copper precipitate per 24 hours.

The Bullion vein runs parallel to the Emma vein and dips toward it. This vein has a width of 8 feet. The ore carries copper with silver and gold values. The Pacific is an extension of the Bullion vein. The London vein crosses the other two veins. The Pacific has a shaft 40 feet deep, exposing 6 feet of quartz, that is mineralized with copper carbonates and chalcopyrite. The London vein has a width of 3 feet. On this vein there is an incline shaft 75 feet deep and a crosscut tunnel one hundred feet in length, driven to cut the vein at a depth of 300 feet. The ores are carbonates and sulphides in quartz. About one-quarter of a mile northeast of opencut on north slope of the hill, an opencut exposes a vein 25 feet wide that strikes northeast and which forms a bold outcrop on the surface which can be followed on its strike to the top of the mountain. The quartz is mineralized with copper carbonates, bornite and chalcopyrite. Samples taken across 20 feet are reported to assay 2% copper with $1.50 in gold and silver. Equipment consists of 7½″ x 6″ Chicago pneumatic compressor driven by Manx truck motor; 15-h.p. Pioneer hoist for dragline scraper; ore bins; two 2-ton cars. Six men are employed.

Bibl: State Mineralogist's Report XV, p. 472.

Santa Catalina Island Copper Deposits. The occurrence of copper is reported by Preston in Report X of the State Mineralogist, on the south side of Cherry Valley Harbor in a vein that strikes north and has a width of 4 feet. The vein is mineralized with copper sulphides and galena.

GOLD.

Gold was first discovered in Los Angeles County in 1834 and the placers of San Francisquito, Placerita, Casteca and Santa Feliciana were worked between the years of 1834 and 1838 by the priests of the San Fernando and San Buena Ventura missions. The placers of San Gabriel Canyon were worked by the priests of San Gabriel Mission and also by the native Californians until the discovery of gold by Marshall in 1848 at Sutter's Mill. In recent years individual prospectors have attempted to work some of the gravels in these areas. The most recent attempt at placer mining has been in Texas Canyon 10 miles northeast of Saugus.

Gold-bearing quartz veins have been mined for gold in past years, but at present writing there is no producing gold mine in the county. Such gold as is shown in the production table (*ante*) for 1923–1926 has come mainly as a by-product from the lead-silver and copper ores. In the northwestern part of the county are several gold districts which were reached from Acton, a station on the Southern Pacific railroad.

The Cedar Mountain District is located north and west of Acton in Townships 4, 5 and 6 North, and Ranges 12 and 14 West. The productive mines of this district have been the Red Rover and New York mines.

The Mount Gleason District is located on and around Mount Gleason in Secs. 25, 26, 35, 36, T. 4 N., R. 13 W., S. B. B. and M. The principal mines of this district were the Padre, Mount Gleason, Kelly and Casa Grande mines. The mines of this district have been idle for years,

although some work has been done on the Mount Gleason Mine in recent years. In this general area is located the Monte Christo Mine, which is 16 miles southeast of Acton. On this property some development has been under way in recent years and attempts made to mill the ore, but the recovery made by amalgamation was low.

Another region of gold-bearing quartz was in the San Gabriel Range adjacent to the canyons of the San Gabriel River. The principal mines of this district that have been productive in the past are Allison, Big Horn, Kelsey and Victoria, which are reached from Azusa, by way of San Gabriel Canyon.

MINES.

Allison Mine. (Quartz.) It is located on the west slope of Sheep Mountain, 5 miles northeast of Azusa. Owner, Allison Mines Company, Azusa, California.

Big Horn Mine. (Quartz.) It is located in Sec. 7, T. 3 N., R. 8 W., S. B. B. and M., on North Baldy Mountain, 28 miles east of Palmdale. Owner, Lowell and California Development Company, Los Angeles. Holdings comprise 15 patented claims. Idle.

Bibl: State Mineralogist's Reports XV, p. 477; XVII, p. 203.

Champion Group of Mines. It comprises 15 claims located in Sec. 28, T. 5 N., R. 14 W., S. B. B. and M., 3½ miles northeast of Saugus. Elevation 2000 feet. Owner, S. B. Drum, Los Angeles, California. Four parallel veins of quartz occur in granite with a general east and west trend. Veins vary in width from 2 to 4 feet. The ore is oxidized quartz near the surface, but at a depth of 50 feet the quartz is heavily mineralized with pyrite. The ore is said to average $11 per ton in gold.

Development consists of two tunnels and a number of shallow prospect shafts. Tunnel No. 1 has been driven 540 feet on the vein. Tunnel No. 2 is 290 feet in length on vein No. 3. Total development work on the different veins amounts to 2000 feet. Idle.

Cruzan Placer Mine. It comprises 640 acres located along Texas Canyon 2 miles northeast of Texas Canyon Mine and 12.8 miles northeast of Saugus. Elevation 2350 feet. Owner, W. H. Cruzan, of Newhall.

The auriferous gravel deposits are on the north side of the canyon and their general course is northeast, being one-quarter of a mile wide and two miles in length.

Water for working these deposits is secured from a dam in Texas Canyon one mile above present workings. A high bench is being worked and the gravel at this pont is 8 to 10 feet thick. The gravel is shoveled into a sluice from which it passes through a revolving drum, then onto fine-size screen before going to a large rocker driven by a 3-h.p. gas engine. The gold recovered is quite fine and the gravel can only be worked during the winter months due to limited water supply. One man is employed.

Dawn Mine. (Quartz.) It is located in Millard Canyon on the southwest slope of Mount Lowe, in SW¼ Sec. 25, T. 2 N., R. 12 W., S. B. B. and M., 6 miles north of Altadena. Owner, M. T. Ryan, Los Angeles.

A vein of quartz in granite strikes east. Ore is heavy pyrite, said to carry gold values. Idle.

Bibl: State Mineralogist's Report XV, p. 477.

Dewey Group of Mines. It comprises four claims and a mill site, located on the southeast slope of Mount Gleason, near the head waters of the North Fork of Mill Creek, 8 miles south of Acton. Owner, I. Dewey, of Glendale, California. Development consists of shaft and tunnels. Idle.

Double Eagle Mine. (Quartz.) It is located 19 miles northeast of Saugus, in Sec. 21, T. 6 N., R. 14 W., S. B. B. and M., on the Bouquet Canyon and Elizabeth Lake road. Elevation 3250 feet. Holdings comprise six claims, known as Double Eagle Group of Mines. Owners, J. C. Nimmo and F. W. Kent, of Saugus, California. Under option to the Double Eagle Mining Company, B. V. Dermody, president; Walter Gow, secretary. Offices, Saugus, California.

A series of parallel quartz veins occur in the granite, strike N. 15° W., with dips varying from 40 to 65° to the northeast. Veins vary in width from 12 inches to 3 feet. The principal work has been done on the Double Eagle, Gold Pin and Winze veins.

These veins have been opened up by means of shafts and short tunnels. Development work consists of an incline shaft 125 feet deep. At a depth of 65 feet, a crosscut has been driven northeast 100 feet to the Gold Pin Vein. The main working tunnel has been driven north as a crosscut 600 feet and at 489 feet from the portal, a drift has been driven N. 55° W., 80 feet, on what is said to be the Gold Pin Vein. The ore is oxidized quartz, carrying a small percentage of pyrite. Ore milled from surface workings is said to have a value of $8 to $10 per ton in gold. Equipment consists of Gardner-Rix compressor, blacksmith shop, air drills and cars. Mill equipment consists of 20-ton Herman Ball mill, amalgamation plates and concentrator. The mill is driven by 22-h.p. Western gas engine. Three men are employed.

Eagle Mine. (Mt. Gleason.) It is situated on the north slope of Mount Gleason, 6 miles south of Acton, a station on the Southern Pacific Railroad. Elevation 6000 feet. Holdings comprise two patented claims and mill site, also 17 claims held by location. Owner, Mount Gleason Mining Company, Chas. E. Walker, president; E. G. Gilbert, secretary, 440 Wilcox Building, Los Angeles.

The Eagle Vein strikes northwest and dips 80° northeast in granite. The vein is 2 to 6 feet wide. The quartz is shattered and contains a small percentage of pyrite. The quartz near the surface was oxidized and was free milling. Developments consist of tunnels and shafts. Idle.

Bibl: State Mineralogist's Reports IX, p. 195; XI, p. 247; XII, p. 152; XIII, p. 204.

El Centro Mine. (Quartz.) It comprises 6 claims located 12 miles west of Cajon, on the Prairie Fork of San Gabriel River. Elevation 5550 feet. Owner, Guy Pullen, San Bernardino, California. Ore occurs in a basic porphyry dike heavily stained with hematite that occurs in gneiss. Development consists of a tunnel 50 feet in length and shallow shafts. Idle.

Lummis Group of Mines. It comprises 4 claims located 7 miles southeast of Acton, on the North Fork of Alder Creek in Sec. 8, T. 3 N., R. 11 W., S. B. B. and M. Elevation 4700 feet. Owner, Capt. Lummis.

A vein of quartz 2 feet wide occurs in granite. It strikes east. Development consists of a tunnel 20 feet in length and shallow shafts. Idle.

Monte Christo Gold Mines. (Quartz.) Property is situated near the head waters of the east fork of Mill Creek, 18 miles southeast of Acton. Elevation 4650 feet. Holdings comprise 10 claims, totaling 200 acres. Owner, F. W. Carlisle, Acton, California.

Four parallel veins occur in the granite which strike N. 20° W. and dip 80° east. These veins vary in width from 2 to 6 feet. Development consists of 6 tunnels and several shafts on the different veins. The main development work, which is confined to the Monte Christo Vein, consists of two tunnels and a shaft 133 feet deep. At an elevation of 4650 feet, a tunnel has been driven north 275 feet. Four shoots of ore were developed on this level about 35 feet in length, with average width of 3 feet. The lower tunnel is 100 feet vertically below this tunnel and has been driven north 400 feet. The tunnels are connected by a raise. The ore shoots developed in the upper tunnel were stoped to the surface. It is reported that the production was $70,000 in gold. The ore above upper tunnel level was free-milling gold quartz carrying a small percentage of pyrite. The ore encountered in lower tunnel is heavy pyrite ore which is not amenable to amalgamation. It is stated that the average ore on this level carries $10 per ton in gold. At the present writing only assessment work has been done on the property. Equipment consists of 6″ x 12″ Blake crusher, 5-foot Huntington mill.

Bibl: State Mineralogist's Report XIII, p. 204.

Native Son Mine. (Quartz.) It comprises seven claims located on the south slope of the ridge north of the Prairie Fork of San Gabriel River, 12 miles west of Cajon, a station on the Southern Pacific Railroad. Elevation 5800 feet. Owner, Native Son Mining Company, Chas. Ward, president; F. E. Williams, secretary, San Bernardino, California.

The gold occurs in quartz stringers in mica schist and gneiss. The ore is free-milling with a small percentage of iron sulphides. The vein strikes northeast and dips 50° northwest.

Development consists of 6 tunnels driven at different elevations on the lode. The lower tunnel is driven as a crosscut 500 feet northeast, then a drift is run north 250 feet. No ore was developed in this tunnel. The other tunnels vary in length from 100 to 300 feet. The principal production came from two opencuts. The production is reported to have been $7,000. The property was worked under lease by the Allison Mines Company from 1917 to 1920. Equipment consists of Rex air compressor, blacksmith shop and 3-stamp mill. Idle.

New York Mine. (Quartz.) It comprises three claims located in the Cedar Mining District, 3 miles north of Acton. Elevation 3400 feet. Owner, M. A. Newmark, of Los Angeles.

This property was one of the principal producers of this area. The vein of quartz strikes northeast and dips 75° north. Average width of vein is 4 feet. Development consists of a number of tunnels. The

main working tunnel is 800 feet in length, from which a winze has been sunk on the vein to a depth of 100 feet. Only assessment work has been done on the property in recent years.

Bibl: State Mineralogist's Reports IX, p. 192; XV, p. 476.

Red Rover Mine. (Quartz.) It comprises 4 claims situated in the Cedar Mining District, 4 miles north of Acton, in Secs. 22, 23, T. 5 N., R. 13 W., S. B. B. and M. Elevation 3350 feet. Owners, William Bowers and John B. Bowers, of Los Angeles.

This mine was the most productive mine of the Cedar Mining District but has been idle for years. The vein occurs on contact of syenite and slate and strikes N. 63° W. and dips 80° south. The principal work was done through an incline shaft on the vein 535 feet deep and a vertical shaft 400 feet deep. About 500 feet north of these workings on the Rip Van Winkle claim are two shafts, one near the top of the ridge, at an elevation of 3650 feet, being 150 feet deep. At 100 feet in elevation below the collar of the shaft, a crosscut tunnel has been driven S. 55° W. several hundred feet, connecting with the shaft. At an elevation of 3500 feet, there is another shaft about 100 feet in depth. The ore milled from the property is said to have had an average value of $10 per ton in gold. Idle.

Bibl: State Mineralogist's Reports VIII, p. 333; IX, p. 201; XI, p. 246; XII, p. 153; XIII, p. 204.

Texas Canyon Placer Mine. It comprises Texas and Woodrow Placer Group of Claims, totaling 230 acres, located in Texas Canyon, 10 miles northeast of Saugus. Owners, John Caspar and Robert Heinze, of Los Angeles.

On the north side of the canyon are auriferous gravel deposits that occur along a bench above the canyon. It has been worked for a distance of one-quarter of a mile. The channel has a general northeast course. The gravel is about 6 to 8 feet thick. The gold is quite fine. The gravel is composed of metamorphic rocks, schist, slate, quartzite and some quartz. Various attempts have been made to work the gravel by means of pumping water from the creek and washing with sluices. The deposit has been worked only intermittently by the owners, due to the scarcity of water. Idle.

Union Mine. (Quartz.) It comprises one claim, situated in the Cedar Mining District, 4 miles northwest of Acton. Elevation 3350 feet. Owners, T. G. Schafer and Ira L. Houser, Acton, California.

The quartz vein 4 feet wide strikes northwest and dips 80° south, in schist. Developments consist of a shaft 140 feet deep, with a drift southeast from the 60-foot level a distance of 50 feet and stoped to the surface. Ore shoot is said to be 6 inches to 4 feet wide, with an average value of $10 per ton in gold.

Equipment consists of gasoline hoist and 5-stamp mill. The property has not been operated since 1900. Only assessment work done on one claim.

IRON

Titaniferous iron ores occur in Los Angeles County in the San Gabriel Mountains, south of Soledad Canyon. The known deposits occur in this range of mountains in a southeasterly direction from Sand

Canyon to the headwaters of Tujunga River. The principal occurrences of titaniferous magnetites of this region are located in T. 4 N., R. 14 W., on the ridge south of Soledad Canyon, extending for a distance of 5 miles easterly from Lang to Russ Siding, on the Southern Pacific Railroad, and also in T. 3 and 4 N., R. 12 and 13 W., in an area southwest of Mount Gleason and north of Tujunga Canyon in the vicinity of Mill Creek and its tributaries.

The titaniferous ores of this region are associated with rocks of the gabbro family. The largest orebodies are contained in rocks that are chiefly labradorite, in coarsely crystalline granitoid aggregates that have been called anorthosite by the Canadian geologists. The anorthosite is a nearly pure plagioclase rock in which labradorite is the predominant feldspar. The ore consists almost entirely of magnetite and ilmenite with little visible gangue. During the past two years a great deal of experimental work has been carried on in the vicinity of Los Angeles on the titaniferous ores for the purpose of manufacturing titanium products. The following companies and individuals have testing plants under operation: Burdick Minerals Corporation; F. F. Burdick, of Hermosa Beach; H. D. Rankin and Associates, El Segundo, California, and the Titanium Corporation, Ford Von Bichowsky, Burbank, California.

TITANIFEROUS IRON DEPOSITS.

Mill Creek Deposits.

Baughman Group of Claims. It comprises 18 claims known as: Coldwater, Condor, Cogswell, Daytonian, Labradorite, Lodestone, Mary Jane, Rake and Titan groups located 8 miles southeast of Acton, east and west of Mill Creek, a tributary of Tujunga Canyon. Elevation 3700 and 4500 feet. Owners, William Baughman and Associates, Los Angeles.

These properties are accessible by road from Acton, a station on the Southern Pacific Railroad, over the Aliso Canyon road to George Cogswell's Camp, a distance of 12 miles and then by trail on Mill Creek, a distance of 4 miles.

The most extensive deposit of iron ore is on the Titan Group of claims which are located in the NE¼ of Sec. 23, T. 3 N., R. 12 W. On a ridge south of Fuller Creek and east of Mill Creek there is exposed a massive outcrop of titaniferous iron ore with an average width of 10 feet and about 300 feet in length. The ore occurs in anorthosite, a white labradorite. The normal strike of the orebody is north. The exposure on top of the ridge is 350 feet vertically above the exposure in the canyon. It is estimated that the deposit contains about 250,000 tons of ore of commercial grade. In general the orebody is a medium to coarse-grained magnetite containing little visible gangue. The anorthosite and ore are in most cases in this deposit in sharp contact, with little, if any, increase in the amount of ferric minerals in the anorthosite as the ore is approached. There seems to have been a complete differentiation of the ferruginous and titaniferous minerals on one hand and the feldspathic on the other. In the one rock, iron oxide and titanium oxide crystallized by themselves; in the other, silica, alumina, soda and lime. The high-grade ore consists of coarser-grained aggregates of magnetite and ilmenite, containing little gangue. It is

stated that the ore from this deposit carries from 11% to 25% ilmenite, TiO_2 and 40 to 50% magnetite, Fe_3O_4.

Lodestone Deposit. This deposit is located about one mile north of the Titan deposit, on a ridge east of Mill Creek and also on west of this creek in the NW¼ of Sec. 14, T. 3 N., R. 12 W. The outcrop of iron ore is about 5 feet wide and 100 feet long. The ore is said to carry 7 to 18% ilmenite. Across Mill Creek, on the west slope of the ridge, is an outcrop of low-grade ore 10 feet wide by 20 feet long.

On Daytonia No. 1 and 2 claims, several small outcrops of ore occur on the ridge north of Fuller's Creek and east of Mill Creek. These outcrops are from 3 to 8 feet wide and about 25 feet in length.

Condor Deposit. This deposit is located on the ridge between Coldwater Canyon and the north fork of Tujunga Canyon. The exposure of iron ore is 50 feet in length by 20 feet wide and is said to carry 15% ilmenite and 40% magnetite.

Iron Mountain Group of Mines. This group comprises 18 claims located on the north slope of Little Iron Mountain about one mile southeast of the Titan Group. Elevation 4800 feet. Owner, F. F. Burdick, Hermosa Beach, California.

Several small outcrops of iron ore occur on these claims. No development work has been done on the deposits to determine their extent.

Mammoth Group of Claims. This group comprises two claims located on Mill Creek, two miles southwest of Titan Group of Mines. Owner, F. F. Burdick, Hermosa Beach, California.

Bryant Group of Claims. This group comprises three claims situated in T. 3 N., R. 13 W., S. B. B. and M., on the south slope of Iron Mountain, near the headwaters of Trail Canyon. Small exposures of iron ore occur on these claims. R. Bryant, owner.

The Titaniferous Iron Ores of Region South of Soledad Canyon, in T. 4 N., R. 14 W., S. B. B. and M.

Iron Blossom Group of Claims. This group comprises 23 claims located on a ridge between Pole and Bear Canyons and south of Soledad, one-half mile southeast of Lang, a station on the Southern Pacific Railroad. Elevation 3500 feet. Owners, Oliver Andreason and W. B. Allison, Los Angeles.

Several outcrops of titaniferous iron occur near the top of the ridge. These exposures are 6 to 8 feet wide and about 30 to 50 feet in length. A large amount of high-grade float is found scattered over an extensive area. The country rock is gabbro and anorthosite.

The high-grade ore is being sacked and packed by mules to Soledad Canyon, where it is loaded in trucks and hauled to the mill of the Caliproducts Company, located near Ravenna, where it is ground and then shipped to Rankin's test plant at El Segundo for the manufacture of titanium oxide. Five men are employed.

Iron Mack Mine. A deposit of titaniferous iron occurs in Sec. 36, T. 6 N., R. 14 W., S. B. B. and M., at the head of Mint Canyon, about 10 miles north of Acton. The ore is low grade and limited in extent.

Bibl: State Mineralogist's Report XV, p. 478.

Needham and Boruff Group of Claims. This group comprises three claims located in Iron Canyon, 4 miles south of Lang, a station on the Southern Pacific Railroad, in Sec. 31, T. 4 N., R. 14 W., S. B. B. and M. Owners, Fred Boruff and H. C. Needham, Newhall, California. Outcrops of titaniferous iron occur on these claims.

Russ Siding Iron Deposit. A small deposit of titaniferous iron occurs within 200 yards of the Southern Pacific Railroad, at Russ Station in Soledad Canyon.

Bibl: State Mineralogist's Report XV, p. 478.

Titian Group of Claims. Deposits of titaniferous iron occur on this group of claims located in Sec. 22, T. 4 N., R. 14 W., S. B. B. and M., 2 miles southeast of Lang, in Pole Canyon. Owner, F. F. Burdick, Hermosa Beach, California.

Burdick Minerals Corporation. F. F. Burdick, president; E. C. Carson, vice president; Willedd Andrews, secretary; Chester A. Scott, general manager; W. H. Test, chemical director. Offices, 330 Second street, Hermosa Beach, California. This company has under lease 2½ miles of beach front near Clifton from the Huntington-Redondo Land Company.

Occurrences of titaniferous iron are found along the coast line of Los Angeles County in the beach sands. The most extensive concentration of this material is found south of Redondo and between that city and Palos Verdes. For a distance of 2½ miles along the beach, from Clifton south, the beach sands contain a heavy concentrate of titaniferous iron. The deposit being worked is lenticular, varying in thickness from 8″ to 14′ of black sand with an overburden of gray and white sand.

The sand being worked probably contains 20% titaniferous iron and magnetite, the gangue being silica, olivine, epidote, garnet and zirconium silicate.

The sand from the beach is loaded by Northwest Engineering Company shovel into 31 cu. yd. cars, which are hauled by Plymouth locomotive one-quarter of a mile to the screening plant. The material from cars is dumped into hopper, from which it is elevated by bucket elevator to another hopper, from which the feed is split to pass over six Leahy vibrating screens, where it is screened to minus 30-mesh product. The screened product goes to collecting tank, from which it is transported by drag-line belt to bucket elevator that elevates the material to loading bins having a capacity of 200 cu. yds. The plant has a capacity of 1200 cu. yds. per 24 hours. Water for screening operations is pumped from the ocean. A fairly clean classification is made by this screening operation as the minus 30-mesh contains 60% mixed ilmenite and magnetite. The oversize is the tail product and is transported by belt conveyor to the ocean. The material from loading bins is hauled by trucks to the company's experimental plant at Hermosa Beach, where it goes to the stock pile. The company has 8 acres at 330 Second street for the site of a commercial plant. The material from stock pile is transported to experimental plant by drag-line scraper, where it is treated on a Diester-Overstrom concentrator. The table concentrate carries 65% ilmenite and 35% magnetite. The concentrate from table is dried and then treated by magnetic separator, where the final

products are clean magnetite and ilmenite. A clean separation of these two metals is possible, as ilmenite is nonmagnetic.

The company is experimenting with titaniferous iron ores for the manufacture of titanium oxide (TiO_2). Fourteen men are employed at screening plant, which is operated on a ten-hour shift.

Titanium Corporation Experimental Plant. Another experimental plant has been under operation during the past year on titaniferous iron ores for the manufacture of titanium nitride (TiN) using the Bichowsky process. Ford Von Bichowsky, owner, Los Angeles.

THE UTILIZATION OF TITANIUM.

The writer is indebted to Will Baughman, metallurgist, of Los Angeles, for the following article on The Utilization and Metallurgy of Titanium:

THE UTILIZATION AND METALLURGY OF TITANIUM.

By Will Baughman, Metallurgist, Los Angeles.

Introductory.

Titanium is usually classed as one of the rare elements, although it is widely distributed. Nearly all igneous rocks, most clays and over half the metamorphic and sedimentary rocks contain easily determinable amounts. As a rule it is chemically combined with other than titanium minerals. Over sixty minerals have been classed as titanium minerals. Clarke has estimated that the solid crust of the earth contains about 0.73% titanium oxide.[1]

In spite of this widespread distribution and the large number of titanium minerals, commercial concentrations, with the exception of titaniferous iron ores, the minerals rutile (titanium oxide) and ilmenite (titanite of iron) are the sole source of production of titanium. Some attention has recently been paid to the concentration of sphene (calcium titanio-silicate) which sometimes occurs in large pegmatite dikes to the extent of 6% or more. All commercial production has been made in the past from the first three minerals.

Titaniferous iron ores, almost always, occur in very basic rocks of igneous origin. When occurring in gabbro, norite or similar rocks, these ores generally occur as magmatic segregations. The occurrences in labradorite or anorthosite are often as igneous sheets or dikes.

From an ore-dressing viewpoint, the titaniferous iron ores can be divided into two classes. One class comprises those ores which contain the titanium as ilmenite in crystals that are large enough to permit crushing to reasonable mesh and then treating magnetically to produce a high grade ilmenite concentrate and a titanium-free magnetite concentrate. The deposits at Taberg, Sweden, at Sanford Lake, New York, and in the San Gabriel Mountains of California are the important deposits of this character.[2]

The other class of titaniferous iron ores includes both those ores in which the titanium is chemically combined and those ores in which the ilmenite crystals are so small or so interwoven that fine grinding and magnetic treatment will give neither a high titanium product nor

[1] Data of Geochemistry. U. S. Geol. Survey Bull. 770.
[2] Titaniferous Iron Ores of U. S., Singewald. U. S. Bureau of Mines Bull 64.

titanium-free iron material. Practically all the titaniferous iron ores are of this class.

Ores containing from 3% to 30% titanium oxide are classed as titaniferous iron ores. Those containing over 30% titanium oxide are classed as ilmenite. The titanium content of most titaniferous iron ores is under 15%.

Pure rutile is crystal clear, and when cut closely resembles white sapphire. Only a few pounds of such crystals have been found. Rutile generally contains several per cent of iron and often has appreciable vanadium content. The average commercial grade of rutile is 93% to 98% titanium oxide.

Ilmenite is the principal mineral used in the manufacture of titanium products. The commercial grade usually contains 52% to 60% of titanium oxide, although a lower grade material containing 32% to 35% of titanium oxide is also marketed.

As this article is concerned with the commercial aspects of the titanium industry, no attempt will be made to describe the various minerals or cover the chemical properties of or give analytical methods for titanium. Neither will the various deposits capable of commercial production be treated in other than the most sketchy manner. A bibliography will be given to cover this information for those desiring to make further investigations. Due to limited space, full credit can not be given to many splendid workers who have added to the world's knowledge of titanium.

Utilization.

RUTILE.

Prior to the discovery of the Virginia deposits, Norway furnished the world's supply of rutile. A small production, chiefly for mineral specimens, was also made in Georgia and Pennsylvania. In recent years rutile has been the raw material used in making titanium tetrachloride, potassium titanium oxalate and carbon-free ferro-titanium.

ILMENITE.

Ilmenite is treated by some chemical method to produce titanium oxide, which is then used as paint pigment, in glass, rubber or linoleum or for the manufacture of any of the materials that rutile is used for. Ilmenite is used for the manufacture of ferro-carbon-titanium without previous chemical refining.

TITANIFEROUS IRON ORES.

Magmatic segregations of titaniferous iron ores generally form lenses, more or less in line with each other, and the impression is often erroneously given that one large continuous body of ore exists. Furthermore, the gangue material is generally some dark, ferromagnesian mineral that to the casual observer appears to be titaniferous iron also, and while small stringers towards the center of such lenses may consist almost solely of ilmenite and magnetite, the general average of such orebodies is less than 40% ilmenite and magnetite.[2]

These two conditions have caused many deposits to be grossly overestimated both as to tonnage and grade. The deposits in Cook County,

[2] Titaniferous Iron Ores of U. S., Singewald. U. S. Bureau of Mines Bull. 64.

Minnesota, and just over the Canadian border in the Rainy River district and the deposits in Madagascar and at Magnet Heights near Pretoria, South Africa, are examples of this mistaken viewpoint. Information given by a magnetometric survey is much more reliable with such deposits than any ordinary geological investigation.

METAL INDUSTRY.

Smelting.

It is seldom that titaniferous iron ores contain over 45% metallic iron, as the titanium content decreases the grade in proportion to the amount of titanium present. Titaniferous iron ores seldom contain over 15% titanium oxide and ores containing as little as 3% have been placed in this class. This low iron tenor has prevented profitable smelting in the past. There is a tradition that titanium causes sticky slags and builds up accretions in the blast furnace, but Rossi has definitely disproved this.

Titaniferous iron was first smelted in the United States at Iron Mine Hill in Rhode Island before the Revolution. Later similar ores were smelted at Sanford Lake in the Adirondacks and at various other small blast furnaces. In Sweden and Norway the titaniferous magnetites had been smelted in charcoal blast furnaces and iron of a very high grade produced. This is probably due to the fact that most titaniferous iron ores contain only minute amounts of phosphorus and sulphur.

Experimental smelting of titaniferous iron ores has been conducted at Port Henry, New York,[3] at Pueblo, Colorado, where titaniferous ores from Iron Mountain, Wyoming, were added to other ores, at several places in England, where imported Norwegian ores were used, and in New Zealand, where titaniferous beach sands (black sands)[4] are being smelted.

Electric smelting has been experimented with by Gin in Europe and by Haanel, for the Canadian Government, in Ontario, Canada.

There is no question that titaniferous iron ores can be smelted, but the low iron content of such ores, together with a prejudice founded on legends which are not supported by any definite facts or reliable data, has prevented the utilization of these ores in the blast furnace more than any other factors.

FERRO ALLOYS.

Probably due to the fact that iron made from the sulphur and phosphorus-free titaniferous ores of Norway was of such high grade, Robert Mushet about 1860 conducted extensive experiments in adding titanium alloys to steel.

Titanium readily combines with nitrogen and oxygen and is therefore an excellent scavenger or final deoxidizer. Titanium as a constituent alloy of the steel does not appear to offer any advantages, with the exception of certain grades of cast iron. It is such an energetic remover of the last traces of oxygen and nitrogen that it is extensively used for the treatment of steels used in rolls and other places where resistance to shock and abrasion is desirable; for steel and iron castings and in material used for manufacture of chains, gears, forgings, tool and automobile steels.

[3] Rossi. Am. Inst. Min. Eng., Vol. 21, pp. 832–36; Vol. 33, pp. 170–197; Iron Age, Vol. 57, 1896, pp. 354–56 and 464–69.
[4] Heskett. Am. Inst. Min. Eng. Aug. Meeting, 1920.

Titanium additions are made in three forms as ferro-carbon-titanium, as carbon-free ferro-titanium and as titanium thermit.[6,7,9,10]

FERRO-CARBON-TITANIUM.

This alloy is made in the electric furnace. It contains about 15% titanium and 6% carbon. The titanium content could be raised, but this proportion alloys most readily with the molten iron or steel to be treated. The carbon is present as graphite. For treating wire or plate stock, 2–4 pounds of ferro-titanium are used per ton of steel, for axle stock 4–8 pounds, for steel castings 4–10 pounds and for steel rails about 15 pounds per ton of steel. About 9000 tons of ferro-carbon-titanium are used per year. The price has been from $200 to $225 per ton for several years.

CARBON-FREE FERRO-TITANIUM.

Carbon-free ferro-titanium is made by the 'Thermit' process. It contains 5% to 7% aluminum. The consumption is much less than that of the ferro-carbon alloy and the price is much higher. It is used in the better grade of castings and steels. Some difficulty has been encountered in the complete removal of the alumina which forms segregations in the steel.

TITANIUM THERMIT.

This consists of an intimate mixture of iron and titanium oxides (ilmenite) and aluminum powder which is placed in an iron container on the end of a steel rod. The whole is vigorously stirred into the bath. The heat of the bath is sufficient to start the thermit reaction and the ferro-titanium is formed in the bath itself. This method of addition of titanium is used principally in making iron castings.

OTHER TITANIUM ALLOYS.

Cupro-titanium, ferro-cupro-titanium, ferro-silico-titanium, mangano-titanium and aluminum-titanium are used to a small extent in the brass industry. Cupro-titanium, for example, permits copper castings containing a small amount of this alloy to be cast in green sand without forming blow-holes.

There are several pyrophoric alloys in which titanium is an ingredient. None have any commercial importance.

Ferro-carbon-titanium is produced by the Titanium Alloys Company, of Niagara Falls, and the carbon-free alloy and titanium thermit is produced by the Metal and Thermit Corporation, of New York City. This latter company also makes most of the minor alloys mentioned.

TITANIUM NITRIDES.

Titanium nitride and cyano-nitride are two products that are new in a commercial sense. These nitrides when finely ground, suspended in water and sprayed on a mold and then dried prevent the adherence of the cast metal to the mold and cores can be easily removed by simple

[6] Titanium. Canadian Dept. Mines. Mines Branch Bull. 579.
[7] Titanium. U. S. Bureau Mines. Dept. Investigations No. 7[illegible].
[9] Browning. Introduction to the Rarer Elements. John Wiley & Sons, 1917.
[10] Johnstone. The Rare Earth Industry. Crosby Lockwood & Son, London, 1918.

sand blasting. The surface of the casting is also much smoother. This is covered in patent No. U. S. 1,570,802.

Paint Industry.

GREEN PIGMENTS.

The first proposal to use titanium compounds was as a substitute for poisonous arsenical green paints. The ferro-cyanide of titanium was proposed for this use. The cost of manufacture of this compound has been quite high in the past, but it now appears that this pigment can be cheaply produced by using the process of Bichowsky and Harthan for the manufacture of titanium-cyano-nitride with additional processing of the waste solutions and the products of this process. This green is very brilliant and quite permanent. It will be further discussed in the section devoted to metallurgy.

OTHER PIGMENTS EXCEPT WHITE.

Many titanium pigments have been proposed, none of which are at present on the market or which offer any attractive possibilities under present conditions.

Titanium tannate can be used as a water color pigment. The color ranges from brick red to pure yellow, depending on conditions observed in the preparation of the pigment.

Ilmenite, finely ground, can be used in the same manner as finely ground magnetite for making mineral black. The ilmenite forms a brighter pigment than magnetite.

Ilmenite or titaniferous iron ore can be roasted in air almost to fusion point and finely ground under water to produce pigments of red to yellow in color. The control of this roast, so as to produce a uniform product, offers many difficulties.

Light yellow pigments can be made by decomposing the ore with sulphuric acid and then roasting the mass at a temperature high enough to decompose the sulphates formed. Material so manufactured has been marketed.

TITANIUM WHITE.

The most important use of titanium compounds to date has been as the pigment known as titanium white or as known by the trade name 'titanox.' The Norse Titan Company produces about 3000 tons of titanium white pigment per year and the Titanium Pigment Company produces about 5000 tons per year.

Pure titanium oxide is too expensive to use as a pigment by itself and is therefore mixed with lithopone, barium or calcium compounds or with alumina. There are a large number of patents covering such mixtures. The standard mixtures contain about 25% titanium oxide. The balance is either lithopone or barium sulphate and calcium phosphate.

Titanium oxide does not blacken in sulphur or other acid fumes nor hydrolize as zinc pigments do in presence of brines or chlorides. Titanium oxide is very inert chemically and therefore a dryer must be added to the pigment. The use of small amounts of zinc or lead compounds for this purpose has been patented, but such pigments then contain the very elements and have the drawbacks that titanium oxide is supposed to obviate.

The following tables, given by Coffinger, show the specific gravity (S. G.) index of refraction (I. R.) and covering power by capacity (C. P.).

Pigment.	*S. G.*	*I. R.*	*C. P.*
Lead carbonate	6.81	1.99	115
Lead sulphate	6.41	---	---
Zinc oxide	5.66	1.90	100
Lithopone	4.30	---	---
25% 'titanox'	4.25	2.30	130
Pure titanium oxide	4.00	2.60	160

When properly mixed and proper driers and oils are used, titanium pigments withstand immersion in water for considerable periods, but if this is not done properly the paint becomes chalky even under favorable outdoor conditions. Titanox is an approved U. S. Navy paint.[5,6,7,9,10]

DYES AND TANNING INDUSTRY.

A considerable amount of titanium compound is used annually in the dyeing industry. Titanous chloride and titanous sulphate are both used to 'strip' dyes where the color is either too deep or uneven, preparatory to redyeing. Some titanium compounds are used in the dyes themselves. Titanium lactate is used as a mordant and 'striker' in the leather industry under the trade name of 'corrichrome.' Basic sodium-titanium-sulphate and more particularly potassium-titanium-oxalate are used in a similar manner.

RUBBER INDUSTRY.

Titanium white is added to gutta-percha paints and titanium oxide is added to linoleum as a filler and to rubber to increase the strength and quicker vulcanization. A lowering of the price of titanium oxide would cause a very large increase in consumption for these two materials. The chemical inertness of titanium oxide makes it more desirable than materials which slowly act on the rubber.

LIGHTING INDUSTRY.

Metallic titanium filaments have been used in incandescent electric light. They were not as satisfactory as tungsten. The oxide has also been used in gas mantles. Finely powdered ilmenite and rutile have been used in direct current arc light carbons to give a source of light very rich in the ultra violet rays. Mercury vapor quartz lamps have largely replaced these arcs.[8]

WARFARE.

Titanium tetrachloride is used in warfare to make smoke screens. A considerable tonnage was so used in the World War. It is now used in sky writing.

[5] Coffinger. Chimie et Industrie, Vol. 7, No. 4, Avril, 1922, pp. 651–661.
[6] Titanium. Canadian Dept. Mines. Mines Branch Bull. 579.
[7] Titanium. U. S. Bureau Mines. Rept. Investigations No. 2406.
[8] Browning. Introduction to the Rarer Elements; John Wiley & Sons, 1917.
[10] Johnstone. The Rare Earth Industry; Crosby Lockwood & Son, London, 1918.
[9] Titanium. Hunter. Jour. Am. Chem. Soc., Vol. 32, pp. 330–336.

Ceramic Industry.

GLAZES AND PORCELAIN.

Titanium oxide, both as the refined material and as rutile, has been used for many years in forming the yellow glazes. It is an excellent substitute for the more expensive uranium oxide in most cases.

Titanium oxide is used in the porcelain of artificial teeth to give the yellowish color required.

Titanium occurs in most clays and its action is to lower the fusion point.

GLASS AND CEMENT.

One of the most attractive recent developments in the use of titanium oxide is as an addition to glass. Titanium oxide is used to replace silica up to 40%. The effect is to lessen the coefficient of expansion. The coefficient of expansion decreases rapidly with additions up to 15% and more slowly after that point. The recently patented Horak glass which contains several per cent of titanium and zironium oxides has such a low coefficient of expansion that it may be heated to almost a dull red and plunged into ice water without shattering, and furthermore, such glass, when cracked by a blow, may be repaired by fusing over a bunsen burner. These developments are very recent, but they offer a large potential market for titanium oxide.[17]

Cement made from the slags obtained by smelting of titaniferous iron ores or made from sphene or other titaniferous materials are remarkably resistant to acid, and this new development also bids fair to assume large proportions.

And finally calcined rutile, finely ground and sintered, can be formed into chemical resistant articles that are capable of conducting both heat and electricity. Such a material should have a future in the chemical manufacturing industry. This, too, is a new development.

NITROGEN FIXATION.

It has long been known that cyanides can be formed by heating carbon and a sodium compound in an atmosphere of nitrogen, but the temperature required is so high that no material can withstand it. A slightly lower temperature can be used by addition of titanium to the above, but it remained for Bichowsky and Harthan to discover that fixation of nitrogen as either titanium nitride or as titanium-cyanonitride could be accomplished at a much lower temperature in the presence of finely divided iron. This process is now being tested on a large scale. Commercial success seems assured and two new titanium compounds will probably be put on the market before long.

The nitrides have been proposed as a fertilizer, but are too expensive for this purpose. The real use is as a starting point in the manufacture of cyanide, ammonia, titanium oxide and titanium-ferro-cyanide (green paint pigment). The nitrides are also used in heat treating and have a splendid field as a mold wash, which has been discussed under Metal Industry.[18]

[17] U. S. Pat. 1,362,917; U. S. Pat. 1,557,540; Barton and Horak.
[18] Bichowsky and Harthan. U. S. Pat. 1,391,147; 1,391,148; 1,408,661; 1,417,702; 1,472,403.

Metallurgy.

FERRO ALLOYS.

Ferro-carbon-titanium is made in the electric furnace by smelting ilmenite or titaniferous iron ores or mixtures of both and using charcoal as a reducing agent. The carbon content can be lowered by using rutile as a decarbonizing agent. Rich titanium slags are resmelted and lime is added to the slag where it forms calcium carbide and acts as a protective layer to prevent excessive oxidation of the titanium.

$$TiO_2+CaO+5C=Ti+CaC_2+3\ CO.$$

A carbon-free ferro has been made by melting scrap iron and scrap aluminum in the electric furnace. The molten aluminum forms a layer on top of the molten iron. Rutile is now charged and is reduced by the aluminum. The titanium sinks and alloys with the iron. Alloys containing 75% titanium can be made in this manner.

$$3TiO_2+4\ Al=3\ Ti+2Al_2O_3.$$

Carbon-free ferro is now made by the 'thermit' process, which consists in intimately mixing the proper amounts of ilmenite with aluminum powder, placing in a special smelting apparatus and igniting. The reaction is very vigorous and the whole mass becomes molten and is tapped off at the bottom.

$$\text{(Ilmenite)}\ FeTiO_3+2Al=FeTi+Al_2O_3+77{,}800\ \text{cals.}$$

The special copper alloys and the metal have so little use that space will not be given here to describe the methods of production. The reader is referred to the bibliography.

TITANIUM OXIDE RECOVERY.

As the ilmenite and rutile deposits are very few and the reserves not large, some method of recovering titanium oxide from titaniferous iron ores is desirable. Various systems that have been proposed will be mentioned and those possessing special merit briefly described.

One of the most obvious methods is to smelt the titaniferous ore with just enough carbon to reduce the iron so as to obtain all the titanium in the slag. As titaniferous iron ores almost always contain appreciable amounts of vanadium this method would also leave the vanadium in the slag from which a large portion can be leached with caustic soda solution.

Another method consists in fusing finely ground ore with sulphur which breaks up the iron titanate molecule and forms iron sulphide and titanium oxide. The iron sulphide can be removed by acids or by leaching with ferric chloride which dissolves the iron and leaves a residue of sulphur and titanium oxide. This last step might be followed by electrolytic recovery of the iron and regeneration of the ferric salt in a manner to be more fully described later on.

SULPHURIC ACID DECOMPOSITION.

The method used by the Norse Titan Company is to pulverize the ilmenite and thoroughly mix with sulphuric acid and then heat in gas fired kettles. As disintregation proceeds the mass swells and finally a

cake is produced which is crushed, ground and dissolved in water. The residue is returned for retreatment. The filtering problem is difficult and settling and decantation in large tanks is resorted to. The solution is then reduced electrolytically until all ferric iron is reduced to ferrous. The same result can be obtained by passing over scrap iron in long riffle boxes.

The reduced solution is boiled, which causes the titanium sulphate to become hydrolyzed and it precipitates as a bulky white precipitate. Barium chloride is added to remove the remaining amount of sulphuric acid and as 0.02% iron will discolor the product, the color of the iron is changed by converting it to the phosphate. As all their product is converted into pigment the titanium is further calcined to convert a portion of the amorphous oxide into the crystalline. If the refractive index of linseed oil is taken as unity then the amorphous oxide has an index of 1.48 and the crystalline an index of 1.80. The many crystalline faces act as minute mirrors and reflect the light, thus greatly increasing the brilliancy and whiteness of the pigment.

A method used in the United States is to reduce the iron oxide to sponge and then dissolve it with dilute sulphuric acid which leaves a residue of high titanium content. This residue is then heated with concentrated acid to dissolve the titanium and can either be diluted and hydrolyzed by boiling after all ferric iron remaining has been reduced to ferrous, or common salt can be added to the concentrated sulphuric acid solution to precipitate the titanium as basic sodium-titanium-sulphate.

Instead of precipitating the titanium by boiling the dilute sulphuric solution, it can be precipitated by hydro-oxides or by a tea made from wood shavings or sawdust.

Methods using fusions or roasts with soda ash, salt and similar alkaline compounds have been proposed, but offer technical difficulties that have not been overcome.[5],[19]

CHLORINE METHODS.

One of the oldest methods of preparing titanium oxide is to heat ilmenite in a stream of dry hydrogen chloride and chlorine whereby the iron is volatized as ferric chloride and the titanium oxide remains unaltered.[11]

$$2\ FeTiO_3+4\ HCl+Cl_2=2FeCl_3+2\ TiO_2+2H_2O.$$

The ferric chloride could be used to dissolve iron in sponge iron made from titaniferous iron ores.

While this method works well on a small scale, those at all familiar with chlorine methods will readily see why such a method can not be operated on a commercial scale. It is mentioned here as so many persons have proposed it as a 'secret' process for treating titaniferous iron ores.

Another chloride process that is chemically correct but difficult of operation on account of the inability of materials to stand the heat and fumes is known as the Carterest-Devaux Process. Titanium ore

[5] Coffinger. Chimie et Industrie, Vol. 7, No. 4, Avril, 1922, pp. 651-669.
[19] Bachman. U. S. Pat. 1,489,417; Blumfeld, 1,504,669 to 673, inclusive; U. S. Pat. 1,511,323.
[11] Rosco and Schorlemmer. Treatise on Chemistry; McMillan & Co., 1907.

is mixed with carbon and a flux and reduced in a furnace at red heat. Dry chlorine gas is then passed into the mass and the temperature rises. The different chlorides are formed successively as this rise in temperature occurs and are separated by fractional distillation, silicon chloride forming at 59 degrees and titanium chloride at 135 degrees Centigrade.[5]

The titanium chloride is taken up in solution and may be precipitated by boiling and hydrolysis or with barium carbonate. A large amount of wash waters are made from which various colored pigments have been made and chlorine and electrolytic iron can also be obtained as by-products by electrolysis of the ferric chloride, which simultaneously regenerates part of the chlorine for the first step.

SPONGE IRON AND ELECTROLYSIS.

The Whittemore Process,[15] which closely resembles the Eustis and Perrin Process, has been taken up by the Canadian Government and considerable experimental work has been done.[16],[20]

The process consists in first mixing the pulverized ore with a suitable reducing agent and then reducing the iron to 'sponge.' This mass is then leached with ferric chloride and filtered. Any copper or similar element is removed by precipitation as the sulphide. The ferric iron is reduced to ferrous iron during the leach. This purified ferrous solution is then electrolyzed in a diaphram cell. Part of the iron is removed in the cathode compartment as pure iron and in the form of sheets or tubes. At the same time the ferrous chloride in the anode compartment is reoxidized to ferric and is ready for leaching a new lot of ore. The titanium remains in the residue from the leaching and requires further purification. It is possible to produce a product containing 80% titanium oxide by this method.

A voltage of 4.4 volts is required per cell and about two kilowatt hours of electricity are required per pound of iron produced. The diaphrams are also a constant source of trouble.

The other method of using sponge iron and electrolysis is known as the Baughman Process. It consists in metallizing at least 90% of the iron in the titaniferous iron ore in ilmenite, compacting same while hot into briquettes and using as soluble anode in an electrolytic cell. The cell used is much simpler than the Whittemore cell and has no diaphram. Full advantage is taken of the anode reaction and only 0.60 kilowatt hours are required per pound of iron produced, or less than one-third the electricity requirements of the Whittemore Process. On the other hand, copper and certain other impurities can not be removed, and enter the iron. This is not serious, as most titaniferous ores are free of such impurities, particularly the Tujunga titaniferous iron ores for which the process was designed. Agitation of the solution and a much more rapid circulation of the electrolyte is used to remove the finely divided titanium oxide as fast as it is freed. Any vanadium present dissolves and is recovered during purification of the electrolyte.[16]

[5] Coffinger. Chimie et Industrie, Vol. 7, No. 4, Avril, 1922, pp. 651–661.
[15] Canada, Dept. Mines. Mines Branch Repts. Investigations in Ore Dressing and Metallurgy, 1924, pp. 91–102; 1925, pp. 71–88.
[16] Belcher, Baughman. Am. Elect. Chem. Soc., April, 1924, meeting paper No. 11 and discussion. Vol. XLV; and Hughes, Am. Elect. Chem. Soc., Sept., 1921, Vol. XL; U. S. Pat. 1,542,350; also Teknisk Tidskrift, 12 Juni, 1926, Bergsvetenskap 6.
[20] Eustis and Perrin. Min. and Met., Dec., 1921, p. 17.
[16] Belcher, Baughman. Am. Elect. Chem. Soc., April, 1924, meeting paper No. 11 and discussion. Vol. XLV; and Hughes, Am. Elect. Chem. Soc., Sept., 1921, Vol. XL; U. S. Pat. 1,542,350; also Teknisk Tidskrift, 12 Juni, 1926, Bergsvetenskap 6.

Both these methods can be applied to titaniferous ores of any content of titanium. The other methods are designed for material containing upwards of 40% of titanium and are not efficient on ores of lower content.

NITROGEN FIXATION.

A number of processes have been devised for the fixation of atmospheric nitrogen as sodium cyanide by heating sodium carbonate, carbon and nitrogen together in an enclosed furnace. The temperature required is quite high and these processes have failed as the apparatus has been quickly destroyed. The presence of titanium allows the fixation to proceed at a much lower temperature.

The process of Pacquet-Andreu is of this character and is reported to be in use in France. In the first step titanium oxide, sodium carbonate and carbon are heated in a revolving furnace in the presence of nitrogen.

$$10\ TiO_2+10\ Na_2CO_3+62\ C+28\ N=Ti_{10}C_2N_8+20\ NaCN+50\ CO.$$

In the second step the sodium cyanide and titanium cyanonitride are decomposed by steam forming ammonia which is absorbed in sulphuric acid and hydrogen cyanide which is absorbed in a soda solution and converting the titanium to sodium titanate.

$$Ti_{10}C_2N_8+20\ NaCN+80\ H_2O=10\ Na_2TiO_3 4H_2O+16\ NH_3+12\ HCN+10\ CO+20\ H.$$

In the last step the solution of sodium titanate is decomposed by carbonic acid producing titanium hydroxide.

$$Na_2TiO_3\cdot\ 4H_2O+CO_2=Ti(OH)_4+Na_2CO_3+2H_2O.$$

This process requires rutile as a raw material and therefore is of limited value.

The processes of Bichowsky and Harthan can be used with ilmenite as a raw material or even high-grade titaniferous iron ores.

In the first step the iron oxide of the ilmenite is reduced by carbon to the metal, or what is commonly called 'sponge.' At the same time the titanium oxide molecule is freed from the iron oxide molecule. Nitrification is the second step and can be accomplished in the same or a separate furnace.

A calculated excess of carbon is used if the cyanonitride is desired. No excess carbon is used if the nitride (TiN) is desired.

The novelty of this invention lies in the discovery of the fact that this nitrification takes place at a much lower temperature in the presence of finely-divided metals of the iron group. The reduced iron in the sponge gives splendid results in this capacity.

After nitrification, which may take place either in the same furnace that reduction to sponge was accomplished in, or in a separate furnace, the mixture of metallic iron and cyano-nitride is finely ground and leached with dilute acid to remove the iron.

The cyano-nitride can then be used the same as in the Paquet-Andreu Process to produce ammonia and sodium cyanide or, according to other patents of Bichowsky and Harthan, to make cyanide and ammonia. It can also be used to form the ferro-cyanide. For this purpose the iron solutions are used with the dilute cyanide solutions and the impure

ferro-cyanide so formed can then be used with the sodium titanate solution to make the titanium green pigment. This is the only practical method that has been proposed to make the green titanium pigment.[5],[18]

PRINCIPAL OCCURRENCES OF TITANIUM ORES.

RUTILE AND ILMENITE.

United States.

There are some large pegmatite dikes in Nelson County, Virginia, that contain as high as 4% ilmenite and 4% rutile. The largest deposit, which is also the largest rutile deposit known, is a dike thirty feet wide and over half a mile long. The principal dike minerals are various feldspars and apatite. Several similar dikes three to five feet wide have been found near this large dike and in the neighboring counties of Amherst, Goochland and Hanover. The large deposit is owned by the American Rutile Company, which in turn is controlled by the Metal and Thermit Corporation. They operate a fine-grinding and magnetic separation mill at the deposit near Roseland, Virginia. The most promising of the other deposits are owned by the General Electric Company.[13]

At Graves Mountain in Georgia and at sundry places in the Carolinas and in Pennsylvania a little rutile has been produced in the past but the deposits are small and of low grade.

Rutile was formerly recovered as a by-product in the concentration of monazite sands in the Carolinas. Some rutile as well as considerable amounts of titanium are produced at Pablo Beach, Florida. The deposit consists of some 33,000,000 tons of beach sand containing over one per cent ilmenite and at least 1,000,000 tons of sand containing over five per cent ilmenite. A concentrating mill comprising tables, dryer, magnetic separator and finishing mills is operated on the deposit by Buckman and Pritchard, Inc., who are controlled by the same group that controls the Titanium Pigments Company. Monazite and zircon are also recovered at this plant. Most of the ilmenite supply used in the manufacture of 'titanox' comes from this deposit.

In California are two beach deposits of black sands containing ilmenite. The Triumph Steel Company is running an experimental plant at the deposit at Aptos, Santa Cruz County. The black sand contains magnetite, ilmenite and chromite. They intend to produce sponge iron and titanium and chromium alloys and products.

The beach sands at Clifton will average 7% ilmenite for a distance of three thousand feet. The beach is narrow, seldom being over one hundred feet wide. There are large concentrations of almost pure magnetite and ilmenite that contain 60% ilmenite and 40% magnetite. These concentrations are lens-shaped and about five feet thick, one hundred feet wide and one hundred and fifty feet long. The Burdick Mineral Company plans to operate on this deposit.

Neither of the California deposits contains commercial amounts of zircon or monazite.

[5] Coffinger. Chimie et Industrie, Vol. 7, No. 4, Avril, 1922, pp. 651–661.
[18] Bichowsky and Harthan. U. S. Pat. 1,391,147; 1,391,148; 1,408,661; 1,417,702; 1,472,403.
[13] Virginia Deposits. Va. Geol. Survey, Bull. III A, 1913.

Canada.

The third largest known deposit of rutile is at St. Urbain in Quebec. It forms as much as 20% of a large deposit of ilmenite in spots but the general average content of rutile is 6%.

This is one of the largest ilmenite deposits known. Exposures 70 feet and 90 feet wide have been made of almost pure ilmenite. Many small exposures ten to thirty feet wide exist.

Another large ilmenite deposit is at Ivry, also in Quebec. A face 100 feet wide and 30 feet high of ilmenite has been exposed here. This deposit is owned by the Titanium Alloys Company. The St. Urbain deposit is owned by the General Electric Company.[6]

Norway.

The Norse Titan Company has a plant for making titanium pigments at Fredrikstad. They own deposits at Laxedalsfelterne estimated to contain 250,000 tons of 35% titanium content, ilmenite; at Blaaffeldt 100,000 tons of 40% to 45% ilmenite and at Storgargen over 3,000,000 tons of 25% ore. The latter is a large dike of ilmeno-norite cutting labradorite. The dike is 30 to 70 meters wide and three kilometers long.

Other Occurrences.

Commercial production of ilmenite has been made from beach sands at Travancore, India, and at Ceylon. Ilmenite has been produced in Portugal and from beach sands in Brazil. The Indian, Ceylonese and Brazilian sands are primarily worked for monazite, zircon and similar minerals.

In Australia, ilmenite has been produced in small amounts at Olary and minor amounts of rutile at Mt. Crawford.

During December, 1926, the Cia. Montecatini, the largest producer of chemicals in Italy, started production of titanium oxide, in a newly erected plant, at Bovisa, near Milan, Italy. It is presumed that the source of raw material is the extensive black sand deposits found on almost every beach on the Adriatic Coast. These deposits average 5% ilmenite and have been the subject of many articles in Italian journals. The ilmenite is easily separated magnetically.

At Kuju, Japan, is an extensive black sand deposit containing 5% titanium oxide that can be recovered as a by-product in the large sponge iron plant recently placed in operation by James W. Neill for the Tokiwa Company.

There are also large deposits of titaniferous beach sands on the coast of Nigeria, in Africa.

The black sand deposits at Sedro-Woolley, Washington, contain 11% titanium oxide. A 10-ton per day experimental blast furnace to recover iron from this extensive deposit was operated in 1920.

TITANIFEROUS IRON ORES.

United States.[7]

The largest deposit of titaniferous iron in the United States is located at Sanford Lake in the Adirondacks. The ore contains from 10% to 20% titanium oxide. Professor Emmons estimates that there is nearly

[6] Titanium. Canadian Dept. Mines. Mines Branch Bull. 579.
[7] Titaniferous Iron Ores of U. S., Singewald. U. S. Bureau of Mines Bull. 64.

seven million tons of ore of all grades at this deposit. It is eighty miles from the nearest railroad. Reported as owned by the Nippissing Mining Company.

The second largest deposit is at Iron Mountain, Wyoming. It is owned by the Colorado Fuel and Iron Company. The vein is 50 feet to 100 feet wide and contains 20% to 25% titanium oxide. The vein outcrops at various points on a ridge a mile long. The ilmenite can not be separated from the magnetite magnetically.

The third largest deposit is at Cumberland, Rhode Island. The ore is two-thirds gangue. The proved outcrop is 600 feet wide and 1500 feet long. A product containing 22% titanium oxide and 54% metallic iron can be made magnetically.

The fourth largest deposit or rather area in which titaniferous iron ores are found is northeastern Minnesota, principally near Iron Lake and in Cook County. There is no question that there is a large amount of ore scattered over a large area. The titanium content runs from 3% to 20% as a rule, although 40% samples have been obtained. Most of the rock contains very dark ferro-magnesian minerals as gangue material which with casual inspection appears as all ore. Very few outcrops are even 100 feet long or over 10 feet in width, although the number of smaller outcrops is very large. This same ore zone extends over the border into the Rainy River region in Ontario, Canada, where three outcrops over 150 feet long and over 30 feet in width of medium grade material have been found.[5],[6]

The fifth largest deposit is located at the head of the Tujunga in the San Gabriel Mountains, Los Angeles County, California. The largest outcrop is much larger and of much better grade than any of those in Minnesota. The largest single deposit contains about 225,000 tons of 15% to 27% ore and there are several very large, low grade, disseminated deposits. The region probably contains 2,000,000 tons of workable titaniferous iron ore.

Deposits of little or no importance occur in the Carolinas, in Tennessee, in New Jersey, in Colorado and in Tehama County, California.[5]

Canada.

Many small deposits are found throughout Quebec and Ontario, some seventy deposits being listed by the Canadian Department of Mines. The two deposits of commercial importance are the black sand deposits along the lower St. Lawrence and at Rainy River in western Ontario. This latter deposit is a continuation of the Cook County, Minnesota, deposits and remarks made about the Cook County deposits apply to the Rainy River deposits, which are comparable to the Cook County deposits in size and general character.[6]

Of all American deposits of titaniferous iron, only a portion of the Adirondack deposit, some of the very small Carolina deposits and the deposit in Los Angeles County, California, are capable of being separated, with reasonable grinding, into a high-grade ilmenite and a low-titanium magnetite.

[5] Titaniferous Iron Ores of U. S., Singewald. U. S. Bureau of Mines Bull. 64.
[6] Titanium. Canadian Dept. Mines. Mines Branch Bull. 579.
[5] Titaniferous Iron Ores of U. S., Singewald. U. S. Bureau of Mines Bull. 64.
[6] Titanium. Canadian Dept. Mines. Mines Branch Bull. 579.

European.

Some titaniferous iron ores as well as rutile are found in Transylvania and in the Carpathian Mountains. The huge igneous sheets at Kirunavarra, Sweden, and in the Urals in Russia contain a few per cent of titanium. The ores at Taberg Sweden, can be separated magnetically into ilmenite and magnetite. The deposits there have been worked for many years. Vanadium was first found in the Taberg titaniferous iron ores. Other minor occurrences of titaniferous iron ore are found in Norway and Sweden, in the Swiss, French and Italian Alps and in Spain and Portugal.

African.

On the Vongoabe River in the Betsiriry district of Madagascar is a large deposit of titaniferous material reputed to contain 3,500,000 tons of 40% titanium oxide content. A sample sent to the present writer closely resmbles the cumberlandite of Rhode Island. The letter accompanying gave data on the size of the deposit, which is about 35 meters wide and nearly a kilometer long. This would make the deposit about half the size of the Rhode Island deposit.

There is also a large area in the Transvaal over which titaniferous iron ores are found. The largest deposit is at Magnet Heights north of Pretoria. A recent published estimate states that there is some 24,000,000 tons of 14% titanium oxide and 60% metallic iron. The same article states that the veins average four feet in width. This analysis is obviously of specimen stuff and not of a grade that could be steadily produced. The bulletins of the Government (Union of South Africa) make no estimates of tonnage and cite the material as containing less than 40% iron and 10% titanium oxide. As no development work, even trenching, has been done, it is probable that the above estimate is in a class with the estimates of ore at Cook County and in the Rainy River districts in Minnesota and Ontario.[21]

VALUE OF TITANIFEROUS ORES.

The following quotations are principally from the *Engineering and Mining Journal*. Those marked (‡) are for material delivered at Atlantic ports. Others are prices at the mines. Prices are for the month of May for each respective year.

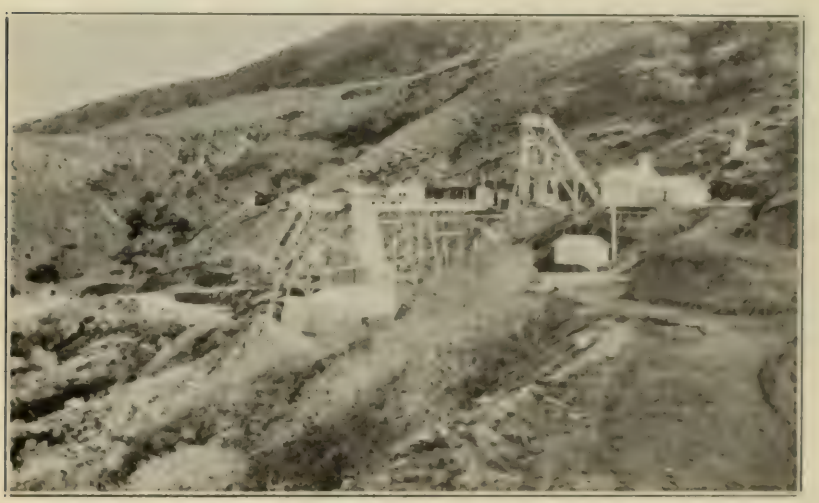
		1924	1925	1926	1927
Rutile 96% TiO	per lb.	11¢–30¢	10¢–30¢	12¢–30¢	11¢–13¢ (‡)
Ilmenite 52% TiO	per lb.	1¼¢–1½¢	1½¢– 2¢	1½¢– 2¢ (‡)	½¢– ¾¢ (‡)
Ilmenite 35% TiO	per ton	$7.50	-------	$6.75	$7.00–$8.00 (‡)
Titaniferous Iron Ore Under 25% TiO	per ton	$3.50	-------	----	$5.60 (‡)

[21] Eng. & Min. Jour. May 14, 1927, Vol. 123, No. 20, p. 807; Chemistry of the Rarer Elements, B. Smith Hopkins, D. C. Heath Co., 1923; Treatise on Inorganic Chemists, J. W. Mellor, Longman Green, 1927, Vol. 7; Ullman Enzyrlopade der Technischen Chemie, Vol. 11, Urban & Schwarzenburg, Berlin.

LEAD-SILVER AND ZINC.

The occurrence of these metals in Los Angeles County is not abundant. Their principal production is from the lead-silver-zinc deposits of Santa Catalina Island.

The mining and development of the ores on Catalina Island was started shortly after William Wrigley, Jr., purchased the island in 1919 and since that date there has been a steady production of these metals by the Santa Catalina Island Mining Company, of Avalon, California. Lead-silver-zinc ores occur in the Silver Mountain Mining District, east of Castac Cañon,[1] and the San Gabriel Canyon District north of Azusa.[2] These metals also occur associated with the copper ores of Pacoima Canyon District.[3]



Headframe and Bins, Black Jack Mine, Santa Catalina Island, California.

Mines.

Black Jack Mine. (Lead-Silver-Zinc.) It is situated on the northeast slope of Black Jack Mountain, 2 miles west of White's Landing and 14 miles by road northwest of Avalon, Santa Catalina Island. Elevation 1540 feet. Owner, Santa Catalina Island Company; William Wrigley, Jr., president; D. M. Renton, vice president and general manager; David P. Fleming, secretary; E. H. Pattison, consulting engineer. Offices, Avalon, California.

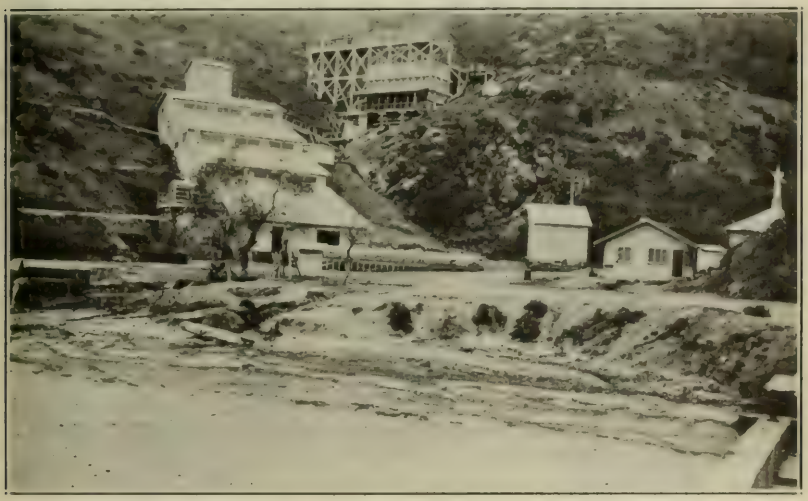
The vein occurs in a belt of hornblende schist that strikes northeast and dips 70° east. It trends N. 30° W. and dips 60° E., and varies in width from 4 to 25 feet. The vein is mineralized with sphalerite, galena and pyrite. The gangue minerals are hornblende, quartz, barite, calcite and muscovite. The ore-shoot developed from the surface to the 400-foot level was 40 feet in length and from 6 to 12 feet in width. The ore developed on the 100-foot level is 100 feet long and has an

[1] State Mineralogist's Report IX, pp. 203–204.
[2] State Mineralogist's Report XI, p. 343; XIII, p. 204.
[3] State Mineralogist's Report XVII, p. 318.

average width of 25 feet. Development consists of a 3-compartment vertical shaft 525 feet deep, with levels driven on the vein at 400 and 500 feet. The upper ore-shoot was worked through a tunnel and winze to the 400-foot level. The total amount of underground workings amounts to 5000 feet. The daily production of the mine when visited was 40 tons per 24 hours. The ore from storage bins at mine is transported over an aerial tram a distance of 2 miles to storage bins at White's Landing, where the ore is treated in a 100-ton flotation plant.

Equipment consists of 75-h.p. double-drum electric hoist, Imperial type XRB, Ingersoll-Rand compressor driven by 100-h.p. motor, blacksmith and carpenter shop. Electric power from main power plant at Avalon.

Bibl: State Mineralogist's Reports X, pp. 279–280; XXIII, p. 33.



Storage bins and 100-ton flotation plant, Santa Catalina Island, California.

Denver-Indicator Group. (Copper, Lead-Zinc.) This group of claims is located in Pacoima Canyon, 12 miles northeast of San Fernando. Elevation 2610 feet. Owner, Denver Mining and Milling Company; W. S. McGrew, president, National Bank Building, San Fernando. The ore is a complex sulphide, carrying massive pyrrhotite, chalcopyrite, galena and sphalerite, with values in gold and silver.[4]

Bibl: State Mineralogist's Report XVII, p. 318.

Kelsey Mine. (Lead-Silver.) It is situated 5 miles north of Azusa, in T. 2 N., R. 9 W., S. B. B. and M., in Silver Mountain Mining District. Elevation 3000 feet. It comprises 4 patented claims. Owner, T. H. Knapp and associates, of Azusa, California. Under option to J. C. Jens, Los Angeles.

The vein, 4 feet wide, occurs along a fault in schist and hornblende gneiss. The strike of the vein is north with a dip to the east. Workings caved. Mr. Jens has located 8 claims south of the Kelsey Group,

[4] See Copper, page 288, of this report.

on the O. K. Vein. Development consists of 2 tunnels 150 and 200 feet in length. The occurrence of cobalt has also been noted in the ore.

Bibl: State Mineralogist's Report XI, p. 245.

Lost Treasure Mine. (Silver.) This property is situated 6 miles northeast of Azusa in San Gabriel Canyon. Holdings comprise 4 claims. Owners, Messrs. Holcomb, Barber and Fairs, Azusa, California. Prospect.

Bibl: State Mineralogist's Report XVIII, p. 422.

Renton Vein Mine. (Lead-Silver-Zinc.) It is located 2 miles southeast of Avalon, in Renton Canyon, on Santa Catalina Island. Elevation 700 to 1100 feet. Owner, Santa Catalina Island Company; William Wrigley, Jr., president; D. M. Renton, vice president and general manager; David Fleming, secretary; E. H. Pattison, consulting engineer.

Five parallel veins occur in andesite. These veins strike east and dip 60° north, and vary in width from 4 to 6 feet. The ore is sphalerite and galena with silver values. It carries 8 to 12% zinc, 1½ to 2% lead, with values in silver.

Development consists of 4 tunnels on the Renton vein. No. 1 Tunnel is 200 feet, No. 2 Tunnel is 225 feet. No. 3 Tunnel is driven northwest as a crosscut 645 feet to vein, with drift on the vein 130 feet. No. 4 Tunnel, the main working tunnel, is driven south as a crosscut 400 feet to the vein, with drift on the vein of 150 feet, developing a shoot of ore 130 feet in length with an average width of 6 feet. Two other tunnels are being driven on parallel veins at a lower elevation. The ore from these workings is trammed through tunnel No. 4 to storage bins, from which it is transported by aerial tram 3700 feet to a storage bin at Pebble Beach, which has a capacity of 225 tons. Twenty men are employed.

Quarry Mine. (Lead-Silver-Zinc.) It is located on Santa Catalina Island west of the rock quarry, 1¼ miles southeast of Avalon and southwest of Pebble Beach. Elevation 300 feet. Owner, Santa Catalina Island Company; William Wrigley, Jr., president; D. M. Renton, vice president and general manager; David Fleming, secretary; E. H. Pattison, consulting engineer.

The vein is exposed along the face of the rock quarry. It strikes east and dips 70° south, in andesite. A series of north and south shear zones cut off the ore-shoot but do not displace the vein to any extent. A tunnel has been driven east 489 feet on the vein. At 310 feet from portal, a winze has been sunk on the vein to a depth of 250 feet. Two levels 85 feet apart have been driven from the winze on the vein, each 350 feet in length. The ore-shoot developed is 150 feet in length and has an average width of 4 feet. The ore mined carries 9% zinc, 1½ to 2% lead and 3 oz. in silver per ton.

The ore from mine bins is hauled by truck to main storage bins at Pebble Beach. From these bins the combined ore from Renton Vein Mine and Quarry Mine is loaded onto a barge having a capacity of 250 tons by a system of belt conveyors. The ore barge is towed by tug to the 100-ton flotation mill at White's Landing.

Mill: The flotation mill at White's Landing has a capacity of 130 tons per twenty-four hours. The combined ore from Black Jack, Renton Vein and Quarry mines is treated by concentration and flotation. Mill equipment consists of Blake crusher; Marcy ball mill; Dorr simplex classifiers; two Devereaux agitators; four 12-foot K & K flotation machines; three 6-foot K & K flotation machines; 4 Cottrell tables; Wilfley pumps; 2 Dorr thickeners; 2 Oliver filters. Water supply for mill is pumped from the ocean. Electric power for operating the mill is secured from the main power plant at Avalon. The ore treated at present writing carries 7.2% to 8.7% zinc; 1.5% to 3.5% lead and 3.5 oz. per ton in silver, the product produced being 15 tons of zinc concentrates per 24 hours, carrying 45% zinc, 3.2% lead and 11.5 oz. silver per ton. The lead concentrate produced amounts to 3 tons per 24 hours, carrying 55% lead, 8% zinc and 93 oz. silver per ton. The tailings carry 2.1% zinc, 0.2% lead and 0.9 oz. silver. Average recovery made is 80% of the zinc and 88% of the lead and 80% of the silver. The zinc concentrates are shipped to Belgium and the lead-silver concentrates to the American Smelting and Refining Company's smelter at Selby, California. Thirteen men are employed in the mill.

Bibl: State Mineralogist's Report XXIII, p. 36.

Silver King Mine. (Lead-Silver.) It is located in Texas Canyon, 12 miles northeast of Saugus, a station on the Southern Pacific Railroad. Holdings comprise 18 claims. Elevation 2350 feet. Owner, W. H. Cruzan, Newhall, California.

A vein of quartz 2 feet wide strikes east and dips 53° north. The quartz is mineralized with galena and said to carry 10 to 30 oz. in silver per ton.

Workings consist of glory hole and two tunnels, the upper tunnel 250 feet in length. From this level a raise connects with glory hole. At a lower elevation, a tunnel has been driven 100 feet east parallel to the vein in the footwall. One man is employed.

Sunshine Mine. (Gold-Silver.) It comprises 10 claims located in Bouquet Canyon, 17 miles from Saugus. Owners, Messrs. Christman, Fuller and Meuer, Los Angeles. Vein of quartz 20 feet wide. Development consists of shaft 50 feet deep.

Bibl: State Mineralogist's Report XVIII, p. 422.

Victoria Mine. (Lead-Silver.) It is located 6 miles northeast of Azusa, in San Gabriel Canyon. Elevation 3000 feet. Idle for years. Formerly operated by Sierra Madre Silver Mining Company, Azusa, California.

Bibl: State Mineralogist's Report XI, p. 245.

MANGANESE.

Amargosa Group of Claims. The deposit is situated 5 miles by road west of Palmdale, in T. 6 N., R. 12 W. and R. 13 W., S. B. B. and M. Holdings comprise 9 claims.

Irregular lenses of manganese ore occur along silicious outcrops in schist. Outcrops of manganese ore can be followed for a distance of

several hundred feet. The width of ore exposed varies from 2 to 5 feet. The ore carries a high percentage of silica.

Developments consist of a number of opencuts, tunnels and shallow shafts. The deposit was operated by the Llewellyn Iron Company in 1917. Idle.

Bibl: State Mineralogist's Report XVII, p. 320.

MOLYBDENUM.

Manzanita Mine. It comprises two claims located in Lang Canyon, in T. 2 N., R. 12 W., S. B. B. and M., 6 miles north of Altadena. Elevation 3500 feet.

Molybdenite is found here associated with copper in a quartz vein that occurs in granite, which strikes northwest. Idle.

PETROLEUM AND NATURAL GAS.

Los Angeles County ranked first in the state in the production of oil and gas for the year 1926. The production of petroleum amounted to 105,826,337 bbl., valued at $174,084,324. The production of natural gas amounted to 91,054,793 M cu. ft., valued at $8,965,307. For detailed description of oil fields see bulletins Nos. 69 and 89, 'Petroleum Resources of California,' also annual reports of the State Oil and Gas Supervisor, issued by the State Mining Bureau.

NONMETALLIC MINERALS.

The nonmetals are commercially the most important among the mineral products of the county. In 1926 their aggregate value was over $11,000,000. The rapid increase in growth of the cities of Los Angeles, Long Beach and Pasadena, and surrounding towns, has developed a great demand for materials employed in the building trades and all important deposits of minerals used in the manufacture of structural materials have been energetically developed and worked.

BARYTES.

San Dimas Canyon Barytes Deposit. It is situated 8 miles northwest of San Dimas, in Sec. 23, T. 1 N., R. 9 W., in the west fork of San Dimas Canyon.

An outcrop of barytes occurs on the west side of the canyon. The general strike of the outcrop is northeast, with slight dip to the southeast. This outcrop is about 50 feet in length and has a width of 6 to 8 feet. The barytes is white in color and said to carry 85% barium sulphate. Idle.

Bibl: State Mineralogist's Report XVII, p. 317.

BORAX.

There was a large deposit of colemanite in Los Angeles County, 5 miles north of Lang, in Tick Canyon. Elevation 2300 feet. Holdings comprise some 1200 acres. This deposit was formerly worked by the Sterling Borax Company, of Los Angeles, but it has been closed down

for several years and all equipment has been removed from the property. Presumably the profitable material has been exhausted.

The colemanite beds strike east and dip 70° to 80° south. These beds occur in tilted beds of clay shale which in places are covered with a flow of andesite. The beds are 30 to 50 feet in thickness. The deposit has been worked through a vertical shaft and evidently mined for several thousand feet in length. The calcium borate was formerly transported by narrow-gauge railroad to Lang, a station on the Southern Pacific Railroad. This road has been torn up.

Bibl: State Mineralogist's Report XV, pp. 480–481.

CLAYS.

There are no deposits of high-grade clays in Los Angeles County, but throughout its area there are clays mixed with sand and containing numerous inclusions of pebbles, which are suitable for the manufacture of common brick and tile. No high-grade clays are produced in the county, those used being shipped in from Amador, Placer, Riverside and San Diego counties. No description of the deposits or the manufacturing plants will be attempted in this report for the reason that Prof. W. F. Dietrich, of the Ceramic Department, Stanford University, in a report on the 'Clay Resources of California,' which is now in preparation by the State Mining Bureau as a separate bulletin, will describe the deposits and plants in detail.

Among the leading manufacturers of brick in Los Angeles County are the following:

Acme Brick Company, Hill Street Building;
Atlas Fire Brick Company, 601 South Boyle;
City Brick Company, 85th Street and Vermont Avenue;
Davidson Brick Company, 4701 Floral Drive;
K & K Brick Company, Merchants National Bank Building;
Long Beach Brick Company, Long Beach;
Los Angeles Brick Company, 1078 Mission Street;
Los Angeles Pressed Brick Company, 621 South Hope Street;
Pacific Clay Products Company, 1151 South Broadway;
St. Louis Fire Brick and Clay Company, 3464 East Ninth Street;
Simons Brick Company, 125 West Third Street;
Southgate Brick Company, Southgate;
Standard Brick Company, Stimson Building.
Western Brick Company, Lankershim Building.

The following are the manufacturers of pottery ware in the county:
American China Company, W. N. Reeves, president, 2304 East 52d Street;
K. & M. Pottery, M. C. Myers, president, 2318 East 52d Street;
Poxon Pottery, G. J. Poxon, president, 2300 East 52d Street.

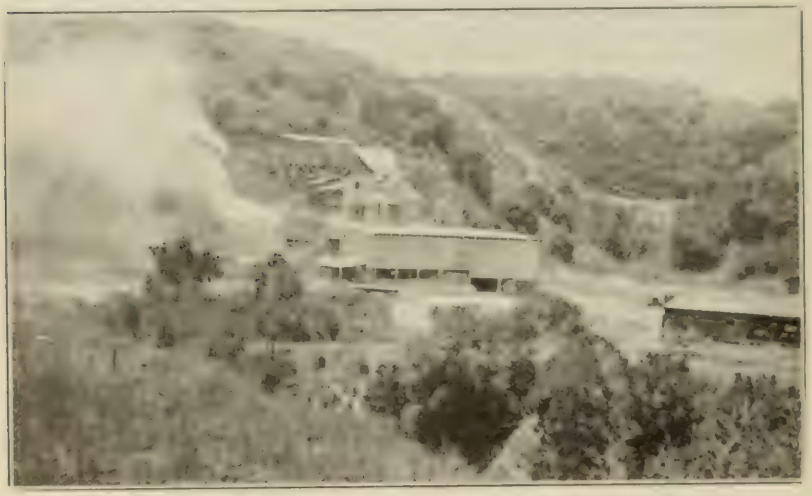
DIATOMACEOUS EARTH.

Deposits of this important material occur in Los Angeles County, but the only commercial production is from a deposit located in the San José Hills, east of Covina.

Featherstone Insulation Company's Deposit. It is located in T. 1 S., R. 9 W., S. B. B. and M., 2½ miles east of Covina on the north slope of

the San José Hills. Elevation 750 feet. Holdings comprise 500 acres. Owner, the Featherstone Company, 911 Mateo Street, Los Angeles. Robert Burhans, Jr., president; R. W. Cole, secretary.

These hills in which the Featherstone deposits are located are made up entirely of diatomaceous earth and lie in two gentle folds that terminate abruptly against an almost vertical fault, which marks the eastern boundary of the deposit. Here No. 3 Quarry, which is located on the south slope of the hill, has exposed the vertical strata of diatomaceous earth that strike east. These beds are estimated to be 700 feet in depth. The quarry exposes a face of material 200 feet in width. The material mined from this quarry is hauled by truck to the grinding plant, a distance of one mile. To the west and on the north slope, the beds of diatomaceous earth lie horizontal and in places are covered with a capping of Fernando conglomerate. The underlying material of the entire deposit is buff-colored clay, interbedded with streaks of



Featherstone Insulation Company's plant, Covina, California.

sandstone and flint. The line between the buff-colored clay and the beds of diatomaceous earth is clearly defined, there being an abrupt change from the clay to the white diatomaceous earth that forms the overlying deposit of which more than 300 feet has been exposed by erosion. Of this mass, the lower white beds, which are very pure, grade gradually into the upper gray beds, which contain less silica and more lime and alumina. The beds at the eastern end of the deposit have been exposed on the north slope of the hill by quarries and opencuts. These beds have a thickness of 50 to 125 feet. Quarry No. 1 exposes these horizontal beds of diatomaceous earth for a distance of 500 feet in width. The beds at this point are about 100 feet thick.

The material from quarry No. 2, which is located one-quarter of a mile west of the plant on the north slope of the hill, is mined for filtration of gasoline. From the floor of this quarry a shaft 45 feet deep has been sunk through the beds of diatomaceous earth to the underlying beds of buff-colored clay shale. The beds of diatomaceous earth

are 30 feet thick, then 10 feet of sand overlies the clay. A tunnel has been driven south 300 feet to the clay shale. The clay is being mined for the manufacture of brick and tile. The material from the different quarries is hauled by trucks to a grinding plant having a capacity of 25 tons per day. The material first passes over a grizzly, then to roll type of crusher. From crusher it goes to direct rotary dryer and then to a Gruendler mill. The ground product from this mill is conveyed to cyclones and bag house. The products produced are high temperature insulation materials, concrete admixture (for use in cement to increase the flowability of cement, 3 pounds of diatomaceous earth to 100 pounds of cement). The clay which is mined from the tunnel is hauled by truck to a brick and tile plant that consists of tile and brick machines and two round kilns. Capacity of plant is 150,000 tile per month and 150,000 insulation brick per month. Natural gas is used for fuel. Thirty-five men are employed.



Quarries and plant of The Featherstone Insulation Company, Covina, California.

Palos Verdes Ranch Deposits. Several exposures of diatomaceous earth occur on the east slope of the San Pedro Hills, on the Palos Verdes Ranch.

Santa Catalina Island Deposits. Diatomaceous earth occurs on Santa Catalina. The beds are said to be 75 feet thick. Other deposits occur in the *Santa Monica Mountains,* the most extensive exposure being near Point Durma, northwest of Santa Monica.

Bibl: State Mineralogist's Reports XII, p. 406; XIII, p. 643; Bull. 38, p. 363.

DOLOMITE.

Deposits of dolomite occur on the west slope of the San Gabriel Mountains, in Secs. 13, 17, T. 3 N., R. 15 W. and in Secs. 7 and 18, T. 3 N., R. 14 W., S. B. B. and M., between Pacoima Canyon and Grapevine Canyon, north of San Fernando.

Baughman Dolomite Deposit. It is situated in Secs. 7 and 18, T. 3 N., R. 14 W., S. B. B. and M., on a ridge north of Pacoima Creek, 5 miles north of San Fernando. Elevation 3000 feet. Owner, Will Baughman, Los Angeles. Holdings consist of 40 acres.

A belt of white crystalline dolomite occurs in the granite that strikes east and dips 50° north. The exposure is about 300 feet in width and about 3000 feet in length.

Ramelli Dolomite Deposit. The deposit is located on the west slope of the San Gabriel Mountains, in Sec. 17, T. 3 N., R. 15 W., S. B. B. and M., 4 miles northeast of San Fernando. Elevation 2200 feet. Holdings comprise two claims, 40 acres. Owners, Frank Ramelli and Edward Oviatt, of Van Nuys.

White, crystalline dolomite occurs in granite with a general easterly and westerly course and dip of 45° to the north. The exposure is from 200 to 500 feet in width and can be traced for the full length of two claims.

Bibl: State Mineralogist's Report XIX, p. 165.

San Fernando Company's Dolomite Deposit. It is located in Sec. 13, T. 3 N., R. 15 W., S. B. B. and M., 4 miles north of San Fernando and on a ridge east of Pacoima Canyon. Elevation 3000 feet. The exposure of white, crystalline dolomite is several hundred feet wide and 2000 feet in length. The dolomite occurs in granite and strikes east with a dip to the north.

FELDSPAR AND SILICA.

There is an extensive belt of labradorite, lime-soda feldspar, containing a high aluminum content, that extends east from Lang on both sides of Soledad Canyon to Ravenna, a distance of about 12 miles. The most extensive deposits of this material are located south of Soledad Canyon for a distance of about 2 miles. This alumina-silicate rock probably could be used in the manufacture of high-grade refractory products, such as porcelain, pottery, electric insulators, spark plugs, sanitary ware for plumbing and cleanser compounds. Silica occurs quite abundantly in the county and a number of quartz outcrops in the vicinity of Acton have been worked in the past, but at present writing none of the deposits are being worked.

The following is an analysis of the alumina-silicate rock made by the C. W. Hill Company, of Los Angeles:

Silica	58.10%
Alumina	28.27%
Ferric Oxide	1.03%
Lime	8.60%
Magnesia	0.54%
Potash	1.60%
Soda	0.82%
Moisture	0.10%
Loss in ignition	0.55%
	99.61%

Deposits.

Caliproducts Company's Deposit. (Feldspar-Silica.) The deposit is located in Sec. 15, T. 4 N., R. 13 W., S. B. B. and M., one mile south of Ravenna, a station on the Southern Pacific Railroad. Elevation 2650 feet. Holdings comprise 200 acres. Owner, Lenardo Ruiz, of Acton. Under option to the Caliproducts Company, Ralph C. McInerny, president, 1009 Spring Arcade Building, Los Angeles.

Development consists of several tunnels and opencuts. The material was mined through a tunnel 20 feet in length, with laterals driven east and west along the strike of the labradorite. The material is trammed in 1-ton cars to a 100-ton grinding plant, where it is crushed, screened, reground and rescreened into a finished product for the local market at Los Angeles.

There are millions of tons of soda-lime-feldspar rock exposed on the property. The plant was operated during 1925 and some material shipped to glass and pottery manufacturers.



100-ton grinding plant, Caliproducts Company, Ravenna, California.

For the manufacture of glass, the iron should be eliminated. The presence of iron has so far been a drawback to its use. With the limited supply of high-grade potash feldspar in California, there is a possibility that these deposits will be of commercial importance in the near future. Two men are employed at the mill.

Chicago-Pacific Deposit. (Feldspar and Silica.) This deposit is located in a range of hills north and south of Soledad Canyon, in Secs. 8, 9, 15, 16 and 17, T. 4 N., R. 14 W., S. B. B. and M., 11 miles east of Saugus and one-quarter of a mile north of Lang, a station on the Southern Pacific Railroad. Holdings comprise 13 claims. Owners, J. P. Monahan and J. G. Krown, Homer Laughlin Building, Los Angeles.

It is a massive deposit of labradorite (soda-lime-feldspar), containing a high aluminum content, which, according to analysis, should probably be satisfactory for the manufacture of refractory products.

The low iron content suggests its use for high-grade Portland cement and it also might be used as a paint filler and for cleanser compounds. The general strike of the formation is east and it can be followed from Lang to Alpine Siding, on the Southern Pacific Railroad, a distance of two miles. It is about two miles in width and occurs in contact with schist, which lies to the south of the labradorite. Idle.

Duncan Feldspar Deposit. (Feldspar-Silica.) It is located in Secs. 14 and 15, T. 4 N., R. 13 W., S. B. B. and M., one mile south of Ravenna, a station on the Southern Pacific Railroad. Elevation 2500 feet. Holdings comprise 160 acres of patented land. Owner, Harry Duncan, Black Building, Los Angeles.

An extensive deposit of aluminum-silicate rock covers this area. It is reported that in 1918, 2000 tons of this material was shipped from the deposit to Los Angeles for the manufacture of electrical insulators. Idle.

Gates Chemical Company's Deposit. (Feldspar-Silica.) This deposit of labradorite (soda-lime-feldspar) is located near Alpine Siding, on the Southern Pacific Railroad, in Soledad Canyon, 2 miles east of Lang. Elevation 1950 feet. Holdings comprise seven claims, in Sec. 15, T. 4 N., R. 14 W., S. B. B. and M. Owner, Gates Chemical Company, E. S. Gates, president; M. L. Gates, secretary. Offices, Denver, Colorado. Local offices, 1204 West Seventh Street, Los Angeles. This is a large deposit of alumina-silicate rock, white in color, and appears to have a low iron content.

Development consists of a quarry 150 feet in length with a bank 20 feet in height, which is located just south of Alpine Siding. The company proposes to install a crushing and screening plant near the site of the quarry. At present there is a loading platform and warehouse at Alpine Siding. The material is now being shipped to the company's plant at Pacoima, California, where it is ground and screened and a product produced known as Gates' Cleanser. Several men are employed.

Stanley Alumina-Silicate Deposit. (Feldspar-Silica.) It is a large deposit of labradorite (soda-lime-feldspar) situated in Secs. 26 and 28, T. 4 N., R. 14 W., S. B. B. and M., 4 miles southeast of Lang. Elevation 3000 feet. Holdings comprise 160 acres. Owner, George Stanley, of Los Angeles.

The belt of labradorite strikes east and the material is white in color, containing a high aluminum content, with low iron content.

Silica Mining and Products Company's Deposit. (Feldspar-Silica.) This deposit of silica and feldspar is located one-half mile northeast of Acton, a station on the Southern Pacific Railroad. Elevation 3200 feet. Holdings comprise two claims. Owner, Silica Mining and Products Company, Los Angeles. S. M. Clayman, president.

A vein of silica and feldspar 25 feet wide occurs in granite. It strikes northeast and dips 60° northwest. Workings consist of an opencut and an incline on the vein for a distance of 35 feet. The silica is on the footwall side of the vein, with feldspar on the hanging-wall. The quartz is clear white, containing occasional streaks of hematite and bunches of muscovite. The feldspar is a pink orthoclase, of good quality.

Equipment consists of loading bins, hoist, Rix portable compressor and cars. Shipments of feldspar and silica were made from the deposit in 1926. Idle.

GRAPHITE.

Commercial deposits of crystalline graphite occur in Los Angeles County in Kagel Canyon, east of Fernando, in San Francisquito Canyon, 18 miles northeast of Saugus and in the Verdugo Hills, 2½ miles northwest of Montrose. In these deposits the graphite occurs in crystalline flakes disseminated through a schist. According to E. S. Bastin, of the United States Geological Survey, the percentage of graphite in the California deposits appears to be nearly twice that of the eastern deposits of flake graphite, which are located in New York, Pennsylvania and Alabama. The flakes in the California graphite schist are much smaller than those in the eastern states, most of them not exceeding 0.25 millimeter in diameter. Some production has been made from all the deposits mentioned, but considerable difficulty has been encountered in making a complete separation of the graphite from the gangue materials. The only deposit under operation at the present time is the Standard Graphite Company's property located in the Verdugo Hills. The graphite concentrate from these deposits is sufficiently rich in graphite to serve for foundry facings, boiler compound and as paint pigment.

Kagel Canyon Graphite Deposit. The deposit is located on the western slope of the San Gabriel Mountains, in Kagel Canyon, 8 miles east of San Fernando. Holdings comprise 5 claims. Elevation 2400 feet. Owner, Los Angeles Graphite Company, Albert Maltman, agent, Grant Building, Los Angeles. The deposit was formerly worked by the American Graphite Company, of Decatur, Illinois.

The graphite occurs disseminated in very small flakes through an outcrop of schist 10 to 20 feet wide. Nearly all the graphite is in flakes 0.25 millimeter or less in diameter. The other minerals in the graphite schist are quartz, feldspar and small quantities of pyrite. The ore is reported to carry from 7% to 15% graphite. The vein can be traced for a distance of 4000 feet and outcrops through 3 full claims. Its course is N. 30° W. and dips 70° east.

Development consists of tunnels and opencuts on the vein.

Equipment consists of 50-ton concentration mill, consisting of crusher, rolls, Marks pulverizer, tube mill, two Allingham flotation machines and Oliver filter. Idle.

Bibl: State Mineralogist's Report XVII, p. 318.

San Francisquito Canyon Graphite Deposit. It is located in Secs. 11 and 12, T. 6 N., R. 15 W., S. B. B. and M., 18 miles northeast of Saugus, in a branch of San Francisquito Canyon. Holdings comprise 9 claims. Owner, California Graphite Company. O. M. Souden, president; A. B. Plumb, secretary, Los Angeles. The property has not been operated for several years.

The vein of graphite schist occurs in granite. It strikes northeast and can be traced along its outcrop for a distance of 6000 feet. The vein is 8 to 25 feet wide. Crystalline graphite occurs disseminated in the schist in very small flakes. Analyses of the graphite schist made by the U. S. Geological Survey ran from 7% to 17% graphite.

Developments consist of a number of tunnels and opencuts along the outcrop. Idle.

Bibl: State Mineralogist's Reports XV, pp. 501-504; XVII, pp. 318-319.

Verdugo Mountain Graphite Deposit. It is situated 12 miles northeast of Los Angeles and 2½ miles northwest of Montrose, in Sec. 29, T. 2 N., R. 13 W., S. B. B. and M., on the Hostetter Ranch. Elevation 1500 feet. Owner, J. E. Hostetter, Los Angeles. Under lease to Standard Graphite Company, Glendale, California. L. S. Freeze, president; Dr. Sutton, secretary. This company has subleased the property to E. B. Babbit, of Santa Barbara, California. W. O. Kunkle, superintendent.

The deposit occurs as a vein of graphite schist in granite, on the northeast slope of the Verdugo Hills. The vein strikes S. 20° W. and dips 50° SE., and is 7 to 30 feet wide. The vein has been exposed in two places; in an opencut about 130 feet above the floor of the valley and at a higher elevation on the hillside by a shallow shaft.

Developments consist of an opencut, and 70 feet below this opencut a tunnel is driven southwest a distance of 60 feet, exposing a vein 5 feet wide which dips 45° southwest. The graphite is crystalline but in small flakes, with very little or no mica associated with it, the gangue being quartz and feldspar. The graphite schist carries from 10% to 15% graphite. The ore is being mined from the opencut, from which it is being trammed in cars to mill bins. The mill has a capacity of 25 tons per 24 hours. From bins the ore is fed to hammer type of crusher, then goes to 4′ x 4′ Marcy ball mill, in closed circuit with Atkin's classifier. It is then treated by concentration and flotation, there being one Wilfley table; one 4-cell K & K rougher, and two 3-cell K & K cleaner machines. The float concentrate goes to 3′ x 4′ Oliver filter, the cake from Oliver filter to 2 rotary dryers (20″ diameter by 21′ in length), then by screw conveyor to tube mill, where it is ground to pass to minus 100-mesh, of which 80% will pass 200-mesh. The product from tube mill is elevated by bucket elevator to storage bin. From bin the material is conveyed to two McKain-Reel screens, where screened so 90% will pass 100-mesh, the 10% oversize being returned to the tube mill. The minus 100-mesh product goes to bin, from which it is fed to barrel loading machine. The company is producing four different products for paint stock, which are as follows:

28% to 34% carbon.
35% to 40% carbon.
40% to 45% carbon.

The foundry facing product is classified in the following grades:

No. 1 46% to 48% carbon.
No. 2 49% to 54% carbon.
No. 3 55% to 60% carbon.

The mill is at present producing 4 tons of product per 24 hours. Twelve men are employed.

Bibl: State Mineralogist's Reports XV, p. 504; XVII, p. 319.

Other deposits of graphite occur in the county but they have not yet been developed commercially. A deposit of crystalline graphite occurs in T. 7 N., R. 15 W., S. B. B. and M., near Elizabeth Lake. Graphite occurs in Tujunga Canyon and it also is found at the head of San Francisquito Canyon in S½ of Sec. 11, T. 7 N., R. 16 W., S. B. B. and M. The vein crosses Charlie Canyon.

GYPSUM.

Deposits of this material occur in the county near Palmdale, near Lang in Sec. 30, T. 5 N., R. 14 W., S. B. B. and M. and at the head of San Francisquito Creek, 13 miles from Casteca. No commercial production has been made from the above mentioned deposits in recent years.

Palmdale Gypsum Deposits. These are the most important gypsum deposits in the county and they were formerly worked by the Alpine



Fossil Beds, San Pedro Hills, Torrance Lime and Fertilizer Company.

Plaster Company, of Los Angeles. Owner, New Alpine Gypsum Company; Kendall Delaney, 720 North Spring Street, Los Angeles.

The gypsum outcrops for several miles east and west of Palmdale, in the low foothills along the south side of Antelope Valley, interstratified with conglomerate, sandstone and shale. The general dip of the strata is to the south. Part of the gypsum occurs in fibrous layers ⅛″ to ½″ thick, alternating with thin layers of clay and shale. In other places, along the outcrop, the gypsum is more massive, shows little crystallization and contains more or less white and yellow clay diffused through its mass. A dozen or more small quarries have been opened up along the deposit. The beds worked varied from 2 to 30 feet in thickness. The company has a small mill located at Palmdale, where the gypsum was formerly manufactured into plaster. Idle.

Bibl: State Mineralogist's Reports XI, p. 248; XII, p. 324; XIII, p. 504; XV, pp. 504-506; Bull. 38, pp. 284–286.

LIME.

Fossiliferous deposits of lime occur in the county in the San Pedro Hills on the Los Palos Verdes Ranch.

Torrance Lime and Fertilizer Company. Frank Samons, president; Richard C. Kite, secretary. Offices, Torrance, California. Operating the D. M. S. and B. fossil beds, which are located on the east slope of the San Pedro Hills, 2 miles southwest of Lomita. Holdings comprise 38 acres.

These fossil beds strike N. 60° W. and dip 30° NW. and are 30 feet thick, covered in places with 12 feet of adobe soil. The fossiliferous lime carries 70% calcium carbonate. The following is an analysis made by Smith-Emery Company, Chemists, of Los Angeles:

Iron oxide (Fe_2O_3)	0.57%
Alumina (Al_2O_3)	0.74%
Calcium oxide (CaO)	49.21%
Magnesium oxide (MgO)	2.26%
Alkalies (K_2O, Na_2O)	0.44%
Carbon dioxide (CO_2)	39.23%
Sulphuric anhydride (SO_3)	0.13%
Phosphoric anhydride (P_2O_5)	0.73%
Moisture (below 105° C.)	0.17%
Combined water (over 165° C.)	2.89%
Acid insoluble matter	3.63%

The presence of phosphate in this deposit of lime makes the material valuable for use as fertilizer. The material is mined from an open pit 300 feet in length and 200 feet in width with a bank 60 feet in height. From this pit it is transported by dragline scraper to 100-ton per day crushing and screening plant.

A large tonnage is sold to the Pioneer Compost Company's plant at Harbor City. A considerable tonnage is also sold to citrus fruit growers for use on adobe soils. The low-grade material carrying 15% $CaCO_3$ is used for road material. Three men are employed.

MINERAL WATER.

There are a number of mineral springs in Los Angeles County, some of which are within the city limits of Los Angeles.

Bimini Springs are located at Bimini Street and Vermont Avenue. Owner, Bimini Water Company. It is used for baths and bottled for sale.

Holly Springs Water Company, 2284 Holly Drive; *Hollywood Medical Springs*, 5633 Melrose Avenue; *Magnetic Spring Water Company*, 936 Palm Avenue, Sherman.

Mohn Mineral Springs, located in Topango Canyon, 10 miles northwest of Santa Monica. Owner, Mohn Mineral Springs Company, 6253 Hollywood, California. Water bottled for sale.

Mountain Spring Water Company, 226 South Avenue 54, Los Angeles. Water bottled for sale.

Rose Spring Mineral Water Company, 4835 Pasadena Avenue. The spring is located on Pasadena Avenue, opposite Sycamore Park. Water bottled for sale.

MINERAL PAINT.

Deposits of red and yellow ochre occur on Santa Catalina Island. These deposits are being developed for commercial use by the Santa Catalina Island Company. The principal occurrence is found along the surface outcrops of veins that are being worked for lead-silver and zinc in Renton Canyon.

SOAPSTONE AND TALC.

Deposits of soapstone and talc occur in chloritic schist on both sides of Bouquet Canyon, 13 miles west of Palmdale and 16 miles northeast of Saugus, a station on the Southern Pacific Railroad. A considerable amount of surface prospecting has been done on these deposits but no commercial production has been made in recent years.



Crystallizing ponds and stock piles of salt, Long Beach Salt Company.

For description of the different deposits see page 321 of Report XVII of the State Mineralogist.

There is also an extensive deposit of steatite on Santa Catalina Island, located near the Isthmus, at Empire Landing.

SALT.

There is no source of salt in Los Angeles County except the water of the Pacific Ocean, from which it is extracted by solar evaporation from the sea water west of Long Beach. At present there is only one plant in operation in the county.

Long Beach Salt Company. H. G. Fenton, president; B. S. Hardy, secretary; O. L. Huffine, superintendent. Offices No. 1 Drumm Street, San Francisco.

The plant is situated one-half mile south of the Anaheim Road, between Wilmington and Long Beach. The pond area amounts to

250 acres which has been divided into shallow ponds for evaporation, by the construction of low dams. The water is pumped in from the ocean to the evaporating ponds, from which it flows to twenty crystallizing ponds, (200 feet wide by 250 feet in length by 24 inches in depth). In these crystallizing ponds the salt begins to crystallize out and at 1.252 specific gravity salt of the first quality is deposited, after which the remaining brine known as bittern water is pumped off, new brine from the evaporating ponds is transferred into the crystallizing ponds and thus the process continues until the salt deposit reaches a depth of six inches. When the desired thickness of salt has been deposited, the pond is drained and a crew of men is set to work to harvest the salt. The crystallizing season runs from April 1 to July 1 and the gathering season from September 1 to January 1. The method of harvesting consists of a narrow launder 250 feet in length, containing a screw conveyor, and six men shovel salt into the launder, where it is washed with fresh salt water. The salt is conveyed by screw conveyor to a belt stacking machine which distributes it into piles along the railroad track. From stock piles the crude salt is loaded into a car having a capacity of 5 tons, in which it is transported to the plant. Here the salt is dumped into a hopper, from which it is conveyed by bucket elevator to screens. The screened salt goes to four conical dryers, then elevated to screens, the oversize from these screens going to bins for use as packing salt. The through-size goes to a set of rolls for grinding for table salt. The very coarse salt is used by the packing companies. It also is used in the manufacture of ice cream and in various forms of business in which coarse salt is necessary. The present production is about 10,000 tons per year. Twenty men are employed.

STONE INDUSTRY.

There has been no production of building stone in Los Angeles County during recent years due principally to the development of new methods of construction, as brick, terra cotta, tile and concrete have been extensively substituted for cut stone. Among the building stones occurring in this county are the following: Granite, sandstone, serpentine, volcanic tuff and trachyte.

GRANITE.

Deposits of granite occur in the San Gabriel Range but the outcrops are high and inaccessible. There is a deposit of hornblende biotite granite in Verdugo Canyon, on the Glendale Ranch. The granite takes a very high polish and is very well adapted for monumental work.

SANDSTONE.

Deposits of sandstone occur in the Simi Hills, in Sec. 13, T. 2 N., R. 17 W., S. B. B. and M., 1¼ miles west of Chatsworth Station, on the Southern Pacific Railroad.

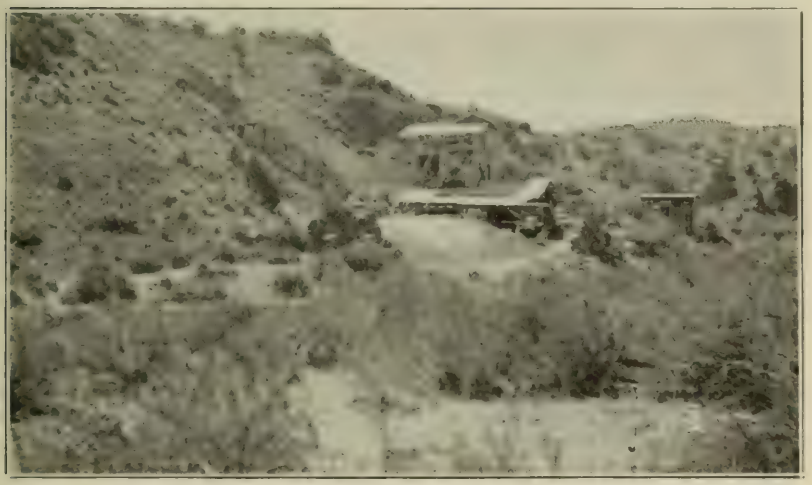
The stone is arkose or feldspathic sandstone, rather fine-grained and heavily bedded. The rock was formerly quarried for the building of the San Pedro breakwater.

SERPENTINE.

A deposit of serpentine occurs near Empire Landing, in Potts Valley on Santa Catalina Island. Owned by the Santa Catalina Island Company, William Wrigley, Jr., president.

The rock is fibrous in structure but takes a fine polish. There are two varieties, hard and soft. The soft variety may be sawed into slabs of any length. The hard variety can be worked with the ordinary stonecutter's tools. This stone has been used in several buildings in Los Angeles for ornamental, sanitary and electrical purposes, also for lining fireplaces. The quarry has not been worked since 1913.

Bibl: State Mineralogist's Reports X, p. 280; XII, p. 402; XIII, p. 639; Bull. 38, p. 147.



Quarry and grinding plant, Nickel Greenstone Deposit, Six miles east of Harold, California.

SCHIST AND GREENSTONE.

A belt of gray, micaceous schist crosses Bouquet and San Francisquito canyons, having a general strike of N. 20° E. This material is being quarried for use as flagstones. In the low hills east of Harold, a station on the Southern Pacific Railroad, a greenstone is being quarried for use in slate roofing.

Deposits.

Bouquet Canyon Quarry. It is located in Bouquet Canyon, 11 miles northeast of Saugus. Under lease from U. S. Forest Service to Fry and Jacobs, of Sherman, California. Elevation 1950 feet.

A gray, micaceous schist is being quarried for use of driveway sets and stepping stones. The schists split easily in large, flat pieces, which are made up in sets as follows: 2″ to 6″ in thickness for driveways; 3″ to 4″ in thickness for stepping stones; 2″ to 3″ in thickness for grass sets. The material is hauled by truck to Beverly Hills for distribution. Six men are employed.

Jones Quarry. This quarry is located just north of Bouquet Canyon Quarry on the same belt of micaceous schist. Elevation 2000 feet. Under lease to the Natural Rock Products Company. H. H. Jones, of Pasadena, California.

The quarry face is 100 feet in length by 75 feet in height. Material is quarried for use as flagstones. Three men are employed.

San Francisquito Canyon Quarries. These quarries are located in San Francisquito Canyon, near power plant No. 2, 11 miles northeast of Saugus. The rock being quarried is a gray, micaceous schist which can be worked in very thin slabs, but the material is much softer than that in Bouquet Canyon. The following individuals have leases from the U. S. Forest Service in this area: C. J. Ely, of Saugus, California; E. J. Griffith, Pasadena, California; N. H. McCready, Los Angeles, California.

SLATE ROOFING MATERIAL (GREENSTONE).

Breslin Greenstone Quarry. It is located six miles east of Harold, a station on the Southern Pacific Railroad, and one mile west of Little Rock Creek dam. Elevation 3350 feet. Holdings comprise seven claims. Owner, Gene Breslin, of Little Rock.

Several prominent outcrops of green diabase occur in a low range of hills west of Antelope Valley. These outcrops strike east. The material quarried is being shipped to Hidecker Brick Company, of Los Angeles, where it is ground in various sizes for roofing material. Three men are employed.

Nickel Greenstone Quarry. The quarry is located in a low range of hills west of Antelope Valley, in Secs. 21, 28, T. 5 N., R. 11 W., S. B. B. and M., 6 miles east of Harold, a station on the Southern Pacific Railroad. Elevation 3300 feet. Holdings comprise 2 patented claims, 40 acres. Owner, R. E. Nickel, of Acton, California. Under lease to R. C. Sides, of Hollywood, California. There is an exposure of green diabase about 500 feet in width and 1000 feet in length. Four quarry faces have been opened up along the east face of this exposure. The rock is green in color and quite hard. The material quarried is trammed in cars to a crushing and screening plant having a capacity of 25 tons per ten-hour day. A number of products are made as: coarse size, known as No. 1; Dash and No. 2; paper size for green shingles.

The plant is operated under contract by J. F. Stanford, of Little Rock, California. The different products are sacked for shipment to Los Angeles. Three men are employed.

TRACHYTE.

This volcanic rock, consisting chiefly of orthoclase feldspar, occurs on Santa Catalina Island, between Avalon and Empire Landing. Owner, Santa Catalina Island Company, William Wrigley, Jr., president.

The stone is suitble for building purposes, but it has been quarried principally for rubble rock, for use in railroad construction and harbor improvements.

Bibl: State Mineralogist's Reports X, p. 279; XII, p. 404; Bull. 38, p. 155.

CRUSHED STONE, GRAVEL AND SAND.

The extended and ever-increasing use of concrete for buildings, in highways, city streets and pavements makes the matter of crushed stone a matter of great importance. The rapid growth of Los Angeles and the surrounding cities has created a great demand for crushed rock, gravel and sand. The principal source of supply of this material is from the river washes of Arroyo Seco, Pacoima, San Gabriel and Tujunga. Through past ages these streams that have their source in the San Gabriel Range have been depositing boulders and sand over extended areas. These washes, then, as now, were carried by waters down the natural drainage channels toward the ocean, but in spreading out on both sides of the above mentioned streams there was created great deposits of this material in the San Fernando and San Gabriel valleys. The deposits lying within 3 to 5 miles of the base of the mountains have a preponderance of boulders and coarse gravel, with a relatively small percentage of sand; while farther down stream there is apparently more nearly equal proportions of sand and gravel and in which the boulders are smaller. The boulders and gravel of these washes are made up chiefly of granite. The San Gabriel River and the Tujunga River areas constitute producing centers unsurpassed in the mineral aggregate industry of the West. Operations in these areas generally are characterized by steam-shovel work by larger operating plants, while the smaller plants use the dragline method, in the course of which the material is extracted from pits that become wider, longer and deeper as production continues. The presence of coarse gravel and large boulders makes plant operations more of a rock-crushing and dry screening proposition than one of sand and gravel washing and classifying. The entire rock and gravel areas referred to are served by either the Southern Pacific, Santa Fe, or Pacific Electric railroads, affording excellent facilities for shipping plant products into Los Angeles and to all other points in Southern California. The distance from the San Gabriel and Tujunga areas to the center of Los Angeles is from 20 to 25 miles. The products from the different plants are also distributed through dealers by trucks to different parts of the city. For the year 1926, crushed rock registered gains both in tonnage and value over the preceding year; as did also sand and gravel. As for some years past, Los Angeles County led all other counties in the state by a wide margin with an output valued at $7,472,884.

In the San Gabriel area, the Union Rock Company has seven rock crushing plants under operation. These plants have a capacity of 3000 tons per ten-hour day each, with the exception of the Baldwin Park plant, which has a capacity of 5000 tons. The company is the largest producer of crushed rock, gravel and sand in this area, and with its Brush Canyon plant, located in mountains near Hollywood, capacity 2000 tons, Boulevard and Claremont plants, is said to be the largest producer of crushed rock, gravel and sand under one management in the world. Another large producer of this area is the Reliance Rock Company, with a capacity of 5000 tons.

In the San Fernando area, the largest producing company is the Consumers Rock and Gravel Company. It has 6 plants under operation, with a total capacity of 12,000 tons per ten-hour day. The largest plants are Big Tujunga, near San Fernando, capacity 2500 tons;

Hewitt plant, capacity 2500 tons; Roscoe plant, capacity 3500 tons; and the Sheldon plant, capacity 2500 tons. Another large producer of this area is the Sunset Rock Products Company, with a plant capacity of 2500 tons.

The following rock products companies are operating plants in Los Angeles County:

Alhambra Transfer and Storage Company, Inc., E. Heiger, president. Offices, 1025 Garfield, Alhambra.

Atlas Mixed Mortar Company, J. R. Alder, president; C. T. LaValley, secretary, 2901 Santa Fe Avenue, Los Angeles.

Blue Diamond Materials Company, W. C. Hay, president. Plant at 16th Street and Alameda, Los Angeles.

Builders Crushed Rock Products Company. E. C. Hotchkiss, president, Azusa, California. The plant is located 3 miles west of Azusa, on the San Gabriel wash. The company has under lease 40 acres.

The crushing and screening plant has a capacity of 1200 tons per 12-hour day. At present writing the pit is 1500 feet in length by 100 feet wide and 60 feet deep. The material excavated from the pit carries 70% boulders and coarse gravel with 30% sand. The gravel is loaded by steam shovel into cars, there being two trains of two cars, hauled by two Plymouth gas-driven locomotives. Each of the cars has a capacity of 5 cu. yds. The material from the cars is dumped over railroad-iron grizzly, spaced 6″ apart. The minus six-inch material, being sand and gravel, is conveyed by belt conveyor to scalping screen, oversize to secondary crusher, through-size elevated to screening and crushing plant. The oversize from the grizzly goes to large Blake type of crusher and is crushed to pass 5-inch ring. The crushed product is conveyed by belt conveyor to scalping screen; oversize from this screen to secondary crushers; through-size elevated to screening plant. Fifteen men are employed.

Cooperative Building Materials Company. William Bell, president. The plant is located at Roscoe, in San Fernando Valley, one-quarter of a mile east of the Penrose plant of the Consumers Rock and Gravel Company, and 1½ miles south of San Fernando Boulevard. Holdings comprise 20 acres. Capacity of plant is 500 tons per 10-hour day.

The deposit runs 65% rock with 35% sand. The material from pit is delivered to crushing and screening plant by dragline scraper. Seven men are employed.

Concrete Materials Company. The plant is located one-quarter of a mile north of Vineland Avenue, on Sherman Way, Lankershim, in San Fernando Valley. Holdings comprise 10 acres. Concrete Materials Company, H. W. Jones, president; E. M. McAvoy, secretary.

The deposit carries 30% rock with 70% sand. The gravel from pit is delivered by dragline scraper to crushing and screening plant, which has a capacity of 600 tons per 10-hour day. Eight men are employed.

Consumers Rock and Gravel Company. Frank Gautier, president; F. J. Gay, secretary. Main office, 2600 South Alameda Street, Los Angeles.

This company has six plants under operation in San Fernando Valley and is the largest producer of crushed rock products in this area. The combined output of these plants amounts to 12,200 tons per 12-hour day.

Plants.

Big Tujunga Plant. The plant is located at Wahoo Siding, on the Southern Pacific Railroad, on the Big Tujunga wash, east of San Fernando. Holdings comprise 200 acres. Capacity of plant is 2500 tons per 12-hour day. The pit is 1½ miles north of the plant.

The pit run of material carries 65% boulders and coarse gravel and 25% sand and fine gravel. The material is loaded by steam shovels into three trains of Western dump cars, each car having a capacity of 12 tons. These trains are hauled by Plymouth gas-driven locomotives to the crushing and screening plant. The crushed rock products are classified as follows:

No. 1 crushed rock product being 3″–2½″; No. 2, 1½″ to 1″; No. 3, 1″–$\frac{7}{16}$″; No. 4, $\frac{7}{16}$″ to $\frac{3}{16}$″; No. 5, $\frac{3}{16}$″ to dust.

Washed gravel consists of three grades of gravel as: 2½″ to 2″, 2″ to 1″, and 1″ to $\frac{7}{16}$″ and washed sand.

The capacity of the bunkers amounts to 1200 tons. The bunker stock in excess of that required for current shipments is loaded into cars and there discharged into open storage by one Brown locomotive crane in the yards. The plant requires 900 h.p. to operate it. Water for washing purposes is furnished from a well by a deep-well turbine pump driven by 200-h.p. motor. The bunkers are arranged for both loading of railroad cars and trucks. Thirty men are employed. Mr. Fred Gieroux is superintendent of the plant.

Hewitt Plant. This plant is located at Sherman Way and Pacoima Avenue, Lankershim. Holdings comprise 900 acres. The plant capacity is 2500 tons per 12-hour day.

The present gravel pit is 500 feet wide by 1000 feet in length and 95 feet deep. The material mined from the pit carries 30% coarse gravel, the balance being fine gravel and sand. The material from pit is excavated by Marion electrically-operated shovel and loaded into hopper from which it is transported by 30-inch belt conveyor 500 feet in length to main 30-inch incline conveyor belt 500 feet long to crushing and screening plant. From this main conveyor from pit, the gravel and sand are conveyed by 26″ belt conveyor to a scalping screen, the sand being screened out. All material over 1½″ size passes to No. 6 McCully gyratory crusher, then passes direct to 36″ and 48″ Symonds disc crushers, then to revolving screens, which produce the following crushed rock products: 1½″, ¾″, ¼″ and dust. The products from washed gravel and sand screening operations are 1½″, ¾″ pea gravel, coarse sand and fine sand. The bunker capacity is 6000 tons and the storage over tunnel amounts to 5000 tons.

Water supply is from a well pumped by turbine pump. Plant is operated by electric power. Twenty-eight men are employed. James A. Gautier is superintendent of the plant.

National Plant. This plant is located 3 miles east of Hewitt plant, on Strathem Street, Lankershim. The plant has a cacapity of 600 tons per 12-hour day. Holdings comprise 16 acres. Eight men are employed. Mr. Fisher, superintendent.

Penrose Plant. The plant is located one-half mile south of San Fernando Boulevard, on Penrose Avenue, in the city limits of Burbank. It has a capacity of 600 tons per 12-hour day.

The gravel pit is 500 feet in length by 200 feet wide and 90 feet deep. The deposit of gravel contains about 35% coarse gravel. Material from

pit is delivered to screening plant by aerial bucket, having a capacity of 2 yards, which is operated by a hoist. The plant is operated by steam. Eight men are employed. P. J. Gay, superintendent.

Roscoe Plant. The plant is located at Roscoe Siding, on the Southern Pacific Railroad, on the Big Tujunga wash. Holdings comprise 300 acres.

The plant has a capacity of 3500 tons per 12-hour day. It has been operated for a number of years and is the largest producer in the San Fernando Valley district. The gravel pit is one-quarter of a mile in length by 1000 feet wide and 75 feet deep. The gravel from pit contains 50% boulders and coarse gravel.

The material from pit is excavated by 2½ yard Bucyrus shovel and loaded into three trains of three cars, each car having a capacity of 6 yards. It is hauled by 20-ton gasoline driven Plymouth locomotives. The material from cars is dumped directly onto 6″ grizzly. The



Roscoe Rock and Gravel Plant, Consumers Rock Company, Roscoe, San Fernando Valley.

primary crusher is 36″ x 42″ Buchanan crusher, product goes to scalping screen and then joins feed to two gyratory crushers. The minus 6″ rock is conveyed to scalping screen, 48″ in diameter by 18′ in length, the oversize passing to No. 5 McCully and No. 6 Gates gyratory crushers and is crushed to pass 2½″ ring. The product from these crushers is conveyed to two Symonds disc crushers, sizes 45″ and 36″. The product is ¼″ to 1½″ sizes, which is conveyed to two revolving screens 48″ by 30′ in length. Products produced are 1½″, ¾″, $\frac{7}{16}$″ to dust. Sand and gravel screened and washed, the products being 1½″, ¾″, pea gravel and sand.

The total horsepower required to operate plant is 600. Bunker capacity is 1800 tons. The various products from bunkers are loaded in railroad cars or trucks. A 12-ton Plymouth locomotive is used in the yard for hauling railroad cars for loading. A Brown-Bevis crane hoist is used for storing material in yards in stock piles. Thirty-four men are employed. F. G. Gay, plant superintendent.

Sheldon Plant. This plant is located on the Big Tujunga wash, 3½ miles east of San Fernando Boulevard, near Sheldon Avenue and Mulholland Street, Burbank.

The plant is the most modern plant operated by the Consumers Rock and Gravel Company. It has a capacity of 2500 tons per 12-hour day. Holdings comprise 300 acres. At present writing the pit is 2000 feet in length by 300 feet wide and 50 feet deep. The pit run of material carries 75% boulders and coarse sand.

A Bucyrus steam shovel, equipped with 4½-yard dipper, loads material into three-car trains of Western dump cars, each having a capacity of 6 yards. These trains are hauled to the plant by Plymouth gasoline-driven locomotives. The material from dump cars goes over 5″ grizzly, oversize to 42″ Kennedy jaw crusher. The minus 5-inch material and crushed rock to 24″ belt conveyors, to revolving screen 60″ in diameter by 12′ long, which takes out 3″ size; through-size elevated to sizing screens; oversize to secondary crusher; and plus 3″ and minus 6″ to Symonds cone crusher, where it is reduced to 1½″ size. Oversize plus 6″ goes to gyratory crusher, then through crushed rock circuit to screens. Product from Symonds cone crusher goes to sizing screen (60″ diameter by 20′ revolving screen), the resulting products being No. 4, ¼″ to ⅜″ round; No. 3, ⅜″ square to 1¼″ round; No. 2, 1¼″ round to 2″ round; oversize, 2″ to 2¾″; No. 1, 2¾ to 4″ round. The washed sand and gravel from sizing screen produces the following products: Pea gravel ¼ to ⅜″; ⅜″ to 1½″; 1½″ to 2½″, sand to drag classifier.

The bunker capacity is 1000 tons and ground storage over tunnel has a capacity of 6000 tons. Excess material from bunkers is elevated by 24″ conveyor to automatic tripper that distributes the various products to compartments over tunnel. Total horsepower required to operate plant is 600. Water supply from well is pumped by turbine pump, capacity 500 gallons per minute. Broad gauge spur track from main line runs to bunkers. Material also is loaded into trucks from bunkers. Thirty men are employed. Mr. O. J. Langdendorf, superintendent.

Gordon-Garrison-Russell, Inc., H. J. Kingsland, president; Thos. Gordon, secretary, 155 East Jefferson Street, Los Angeles. This company has a plant under operation in Verdugo Canyon, northeast of Montrose. The capacity of the plant is about 600 tons per 10-hour day. Ten men are employed. The company is a large distributor of rock products in Los Angeles, in the capacity of dealers.

Graham Bros., Inc., R. Graham, president; P. Graham, secretary. Offices, 1512 West Seventh Street, Los Angeles.

The Graham Bros. have large bunkers at Long Beach, which are supplied with crushed rock products from Santa Catalina Island Company's quarry located at Pebble Beach, Santa Catalina Island.

The crushed rock from the quarry is loaded on barges by a belt conveyor system and then transported across the channel by tugs to the bunkers at Long Beach. The capacity of the Santa Catalina Island Company's quarry is 1000 tons per 12-hour day.

Graham Bros., Inc., also operate a sand plant on the east slope of the San Pedro Hills, near Lomita. Twelve men are employed.

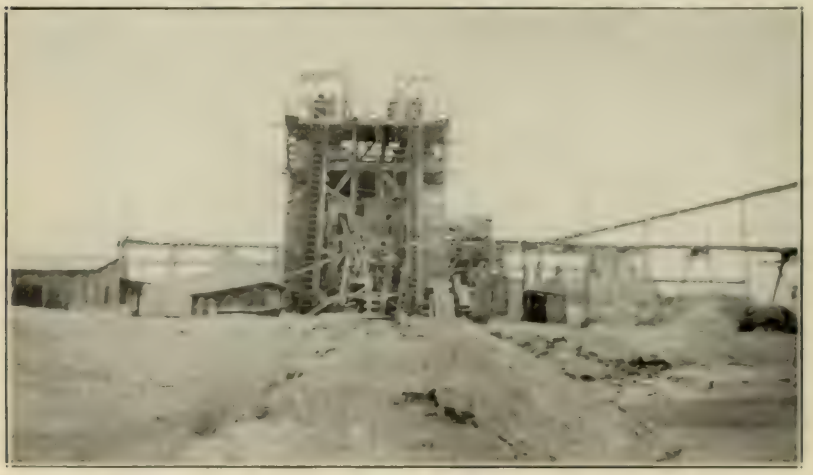
Haines Canyon Rock Company, Peter Perry, president; E. A. Quinn, secretary. Offices, 5200 North San Fernando Road, Glendale, Cali-

fornia. This company has a crushing and screening plant in Haines Canyon, near Sunland.

Livingston Rock and Gravel Company, W. H. Livingston, president. Offices, 19 East Valley Boulevard, Alhambra, California. The crushing and screening plant is located in South Monrovia, on the Rio Hondo wash. The capacity of the plant is about 1000 tons per 12-hour day.

Material Dealers Distributing Company, H. W. Jones, president, San Fernando, California. The plant is located on the Pacoima wash, one mile east of San Fernando. The capacity of the plant is 500 tons per 12-hour day. Ten men are employed.

Pacific Rock Company, Frank W. Aitkin, president, San Fernando, California. The company has 83 acres under lease on the Pacoima wash, two miles southeast of San Fernando. The material from gravel pit is loaded into Western dump cars, which have a capacity of five yards, by Northwestern steam shovel. A train of two cars is hauled by



Pacific Rock Company's Plant, San Fernando, California.

Plymouth gas driven locomotive to the crushing and screening plant. The capacity of the plant is 1200 tons per 12-hour day. Ten men are employed. E. H. Wolfe is plant superintendent.

Pierson and Son operate a small plant located on the Rio Hondo wash, in South Monrovia, one-half mile west of Livingston Rock Company's plant.

Preston Rock Company, G. W. Preston, president, Box 165, Lamanda Park, California. This company operates a crushing and screening plant located in Eaton Canyon, near Pasadena, California.

Rancho Rock Company, David E. Fulwider, president, C. S. Newberry, secretary, 917 Guaranty Building, Los Angeles. The plant is located on the Tujunga wash, west of Roscoe, in the San Fernando Valley. Holdings comprise 25 acres. The plant has a capacity of 600 tons per 12-hour day. The material is delivered from the pit to crushing and screening plant by dragline bucket. Eight men are employed.

Reliance Rock Company. This company is a subsidiary of the Coast Rock and Gravel Company, of San Francisco, California, C. B. Rogers, general manager; R. B. Vaughn, plant superintendent. Offices, 2100 East 25th Street, Los Angeles. Holdings of the company comprise 300 acres located on the east side of the San Gabriel River, two miles west of Azusa, California.

The plant has a capacity of 6000 tons per 12-hour day. The pit run of material carries 75% boulders and coarse gravel and 25% sand and fine gravel. The gravel pit is several thousand feet in length, 300 feet wide and over 100 feet deep. The material from the pit is loaded by two Bucyrus 80-B, steam shovels into a hopper over inclined surface tramway, from hopper, material is fed by Gale-controlled chute into 30-yard tram car. This car is hoisted to crushing plant over incline from pit by 200-h.p. electric-driven hoist. The car is automatically dumped at top of incline into crushing plant hopper, the material going to 6″ grizzly. The oversize from grizzly goes to Allis-Chalmers gyra-



Rock and gravel plant, Sunset Rock Products Company, San Fernando Valley.

tory crusher where it is reduced to pass 4″ ring. The product from primary crusher goes to two secondary gyratory crushers, and is reduced to 3″ size. The product from secondary crusher is fed to a revolving screen having 3½″ openings and short outer jacket of a 1¼″ screen. The through-size from this screen is conveyed to open storage as No. 1 crushed rock product. The oversize from this revolving screen is returned to two 10″ Allis-Chalmers gyratory crushers and reduced to 1½″ product which is carried to sizing plant by a belt conveyor. The sand and gravel that pass through 6″ grizzly is fed to two sets of crushers from which it goes to revolving sand and gravel screen, of 2½″ and 3½″ apertures. The two undersize screen products and recrushed oversize are conveyed by a belt conveyor to main mill. All crushed rock, except No. 1 product, is conveyed by belt conveyor to screening plant, where it is graded by Hummer screens and the mixed sand and gravel are conveyed over a parallel belt conveyor to sand and gravel section of the plant, where it is graded to the various sizes

by rotary screens of the Gilbert type. Crushed rock products are No. 2, 1½″ to 1″; No. 3, 1″ to $\frac{7}{16}$″; No. 4, $\frac{7}{16}$″ to $\frac{3}{16}$″; No. 5, $\frac{3}{16}$″ to dust.

Washed gravel products are: 2½″ to 2″; 2″ to 1″; 1″ to $\frac{7}{16}$″ and washed sand, comprising concrete and asphalt sand. The different grades of crushed rock, gravel and sand go to bunker compartments, from different compartments the desired material falls into a car-loading conveyor, below the bunkers. From this conveyor the material is discharged on a cross conveyor into railroad cars. Bunker stock in excess of that required for current shipments is loaded into railroad cars and then discharged to open storage by two Brown locomotive cranes in the yards. The ground storage amounts to about 750,000 tons. Water for gravel and sand washing is pumped from a well 150 feet deep by a deep-well turbine pump.

Edward Sidebothan and Son, operate two sand plants located in Fossil Bed Canyon, on the east slope of the San Pedro Hills, 1½ miles southwest of Lomita. Office, Pennsylvania Street, Lomita, California.

Sunset Rock Products Company. R. W. Clark, manager, 6372 Hollywood Boulevard, Hollywood, California. The plant is located on Tujunga wash, 2 miles north of San Fernando Boulevard and one mile east of Osborne Avenue, Burbank, California. The plant has a capacity of 2500 tons per 10-hour day.

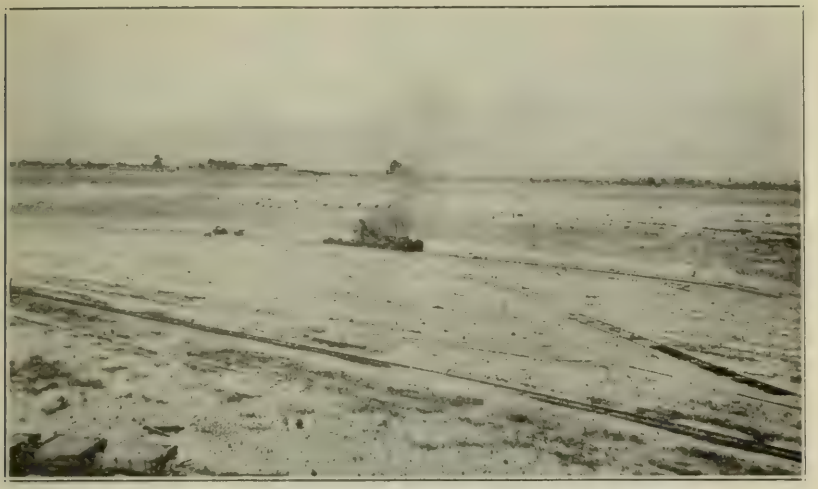
The gravel from the pit is delivered to the crushing and screening plant by dragline bucket. The company owns its own trucks and distributes its products to Los Angeles and the surrounding towns and cities. Twenty-five men are employed in operation of pit and plant. Mr. Brown, plant superintendent.

Stine and Ellis, Rock Products Company, W. L. Stine president; J. R. Ellis, secretary, Burbank, California. The plant is located at Vineland and Victory Boulevard, Lankershim. Holdings comprise 20 acres. The capacity of the plant is 750 tons per 10-hour day.

The material from pit is delivered by dragline two-yard bucket to crushing and receiving plant. The dragline is operated by 100-h.p. electric-driven hoist. Bunker capacity is 300 tons. Three men are employed.

Union Rock Company, George A. Rogers, president; R. E. Rogers, secretary; T. C. Rogers, manager of plants and production; H. O. Chenoworth, general superintendent. This company owns 644 acres with 949 acres under lease and controls 2000 acres additional for rock excavation.

The company produces and distributes more crushed rock, sand and gravel than any other company in Los Angeles County. Eight plants are under operation in the county and six of these plants are located in the San Gabriel Valley and are the Rivas, Kincaid, Largo and Baldwin Park plants. The company has recently acquired the Los Angeles Rock and Gravel Company's plant at Durbin and the American Rock and Gravel Company's plant at Claremont, near the San Bernardino County boundary line. These plants have a capacity of 3000 tons per 10-hour day each, with the exception of the Baldwin Park plant which has a capacity of 5000 tons. The company also operates the Boulevard plant, located on the Tujunga wash in San Fernando Valley, with a capacity of 2500 tons. The Brush Canyon



Gravel pit of Baldwin Park Plant, of Union Rock Company.

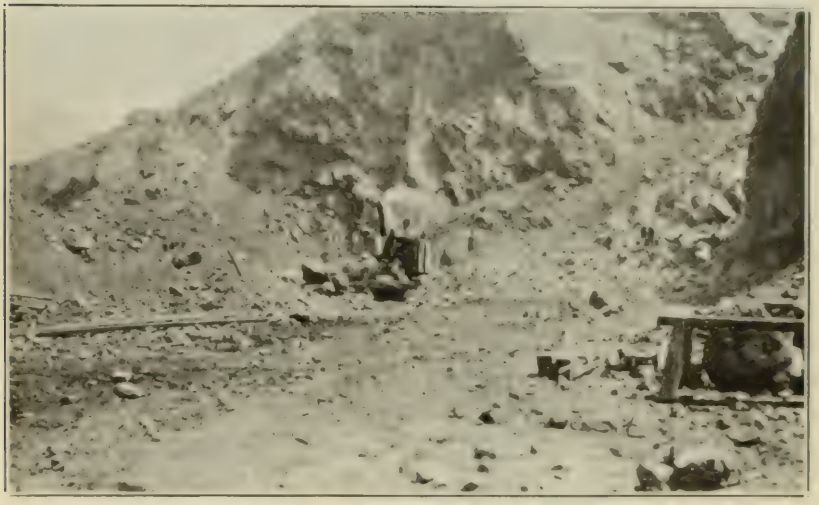


Baldwin Park Plant, Union Rock Company.

plant and quarry is located on the west slope of the Hollywood Mountains, 2 miles east of Hollywood. This plant has a capacity of 2000 tons per 10-hour day. For distribution of the rock products, the company has established 13 bunkers in Los Angeles district, each of which has a capacity of about 3000 tons of material, with a combined storage of 34,000 tons. The equipment operated by the company consists of 11 steam locomotives, 4 locomotive cranes, 7 steam shovels, and over 100 trucks for the delivery of rock products. During the year 1924, the production of the company was 3,500,000 tons, which will be materially increased this year by the acquisition of other plants mentioned.

Plants.

Brush Canyon Plant. This plant is located on the eastern slope of Brush Canyon, 2 miles east of Hollywood.

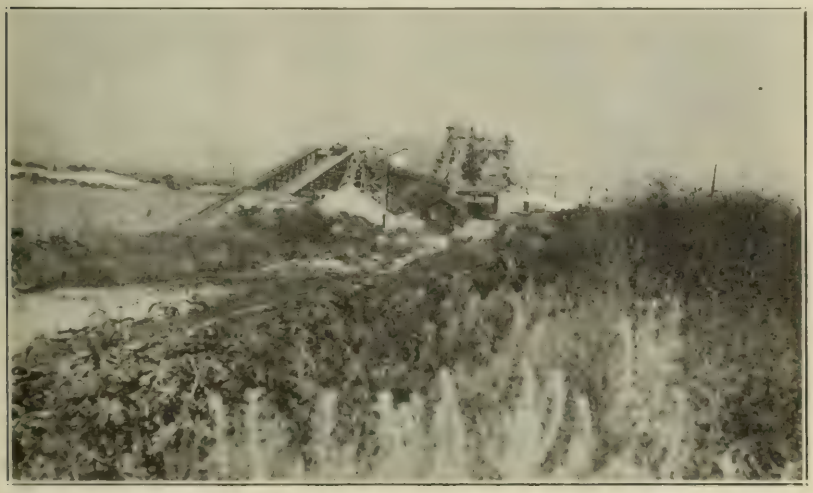


Brush Canyon Quarry, Union Rock Company.

The stone being quarried is a fine-grained crystalline rock, which is about 100 feet in width. It strikes north and dips 50° west. The quarry is 200 feet wide by 700 feet in length and 150 feet in height. The broken rock is loaded in cars by 30-B Bucyrus shovel, then hauled by electric locomotive to crushing plant. The material from cars goes into chute to No. 8 Allis-Chalmers gyratory crusher, where it is crushed to pass 3½″ ring. Product from crusher goes to revolving screen where No. 1 product is taken out, oversize to 48″ Symonds disc crusher. The product from the Symonds goes to sizing screens. Ten men are employed at quarry and 6 men in the plant. C. F. Fredley is plant superintendent.

Baldwin Park Plant. This plant is the most modern and complete plant operated by the Union Rock Company. The plant is located one mile northeast of Baldwin Park. It has a capacity of 5000 tons per 10-hour day.

The material treated from the pit contains 60% boulders and coarse gravel with 40% fine gravel and sand. The pit is about one-quarter of a mile wide by one-half mile in length and 65 feet deep. Two steam shovels are operated on different benches in the pit. Three Porter 20-ton locomotives deliver the trains of gravel to incline tramway. The cars are hoisted by electric-driven hoist to top of incline where they are dumped over 4″ grizzly, oversize going to Gates gyratory crusher. Then the crushed rock and gravel passes to bin, from which it is loaded into two 4-yard skips, which are hoisted to the top of steel and concrete screening and sizing plant which has a height of 126 feet. Allis-Chalmers 200-h.p. electric-driven hoist operates the skips. Secondary crushers consist of two Allis-Chalmers 10″ gyratory crushers and one Symonds 48″ disc crusher. The different products go from screens to various compartments in the concrete bunkers. Material from bunkers is loaded into railroad cars. Excess material is unloaded from cars to



Kincaid Rock and Gravel Plant, Union Rock Company.

ground storage by Brown locomotive crane. Twenty-eight men are employed.

Durbin Plant. This plant has recently been acquired by the Union Rock Company. It was formerly operated by Los Angeles Rock Company and is located at Durbin, on the Pacific Electric Railway, 2 miles west of Baldwin Park. The capacity of the plant is about 3000 tons per ten-hour day. Twenty-five men are employed.

Kincaid Plant. This plant is located 2 miles west of Azusa on the San Gabriel wash.

The pit is one-half mile long by 1000 feet in width and 80 feet deep. The gravel from pit contains 75% boulders and coarse gravel, with 25% fine gravel and sand. The material is loaded into cars by Bucyrus steam shovel, which is delivered by locomotive to foot of incline tramway. The cars are hoisted over incline by electric-driven hoist to trestle above the plant. Material from cars goes over 8″ railroad iron grizzly, oversize from grizzly to No. 12 Allis-Chalmers gyratory crusher. The

product from this crusher is conveyed to No. 10 gyratory crusher. Sand and gravel and also crushed rock are elevated to screening and washing plant where the various products are classified and to the different compartments in the bunkers. Twenty men are employed.

Largo Plant. It is located on the San Gabriel wash, one mile west of Azusa. Capacity of the plant is 3000 tons per ten-hour day.

The gravel pit is 3000 feet in length by 1000 feet wide and 75 feet in depth. The material carries 75% boulders and coarse gravel and 25% fine gravel and sand. A 60-B Bucyrus shovel with a 2-yard bucket, loads the material into train of ten Western dump cars, each of which has a capacity of 5 yards. A 20-ton Porter locomotive delivers the train to incline tramway over which the cars are hoisted by 200-h.p. electric-driven hoist to platform at head of crushing plant. Two cars are hoisted and the material is dumped onto a railroad iron grizzly, spaced 6 inches apart, the oversize going to No. 12 Gates gyratory crusher. The crushed rock product and the minus 6″ sand and gravel are elevated to two revolving screens, one for crushed rock, the other for sand and gravel. Oversize from these screens is returned to No. 6 McCully gyratory crusher. The minus 6″ to 3″ material from scalping screens goes to 36″ and 48″ Symonds disc crushers. The product is elevated to Gilbert system of screens where the desired products of crushed rock and gravel are segregated.

This is the oldest and the central plant of the Union Rock Company in the San Gabriel Valley. The company maintains a blacksmith shop and machine shop for repairs on the different plants in the valley. At this plant the bunker capacity is 1000 tons, with ground storage for 200,000 tons of crushed rock products. Excess material from Kincaid plant is stored here. A locomotive is used for moving railroad cars and two Brown locomotive cranes are used for transferring material from cars to stock piles. Twenty-five men are employed. S. L. Yount is plant superintendent.

Rivas Plant. The plant is located on the west side of the San Gabriel River, 3 miles west of Azusa. This is the only gravity plant in this area. It has a capacity of 3000 tons per ten-hour day. The gravel pit is one-quarter of a mile in length by 500 feet wide and 70 feet deep.

The material is made up of 75% boulders and coarse gravel, with 25% fine gravel and sand. The material is excavated by Bucyrus shovel and loaded into train of Western dump cars, each of which has a capacity of 5 yards. A Porter locomotive transports cars to incline tramway. A 300-h.p. direct-connected, electrically driven hoist hauls up train of two cars to trestle over railroad iron grizzly, spaced 6″ apart. The material is dumped on grizzly, oversize going to No. 12 Allis-Chalmers gyratory crusher. The crushed rock from this crusher joins the minus 6″ material of sand and gravel and falls by gravity into cement storage bin.

The material from bin is loaded into two side-dump cars, each of which has a capacity of 5 yards. These cars are hoisted over incline 1200 feet in length to top of plant by 150-h.p. electrically driven hoist. The material is dumped into hopper at top of plant, from which it goes to scalping screen. The oversize from this screen goes to No. 5 Gates gyratory crusher, where it is crushed to pass 4″ ring. This

product goes to 48″ Symonds disc crusher. The crushed rock goes to revolving screen which produces the following products: No. 1, 4″; No. 2, 2½″; No. 3, 1¾″; No. 4, 1¼″; No. 5, $\frac{3}{16}$″ and dust. Gravel and sand from scalping screens go to revolving screen which produces three grades of gravel 2½″ to 2″; 2″ to 1″, pea gravel and sand. The revolving screens for crushed rock and gravel are installed as parallel units. Oversize gravel and crushed rock from these screens go to 36″ Symonds disc crusher. The product from this is elevated to crushed rock screen and goes through the circuit. One thousand horse power is required to operate the plant. Water for gravel and sand washing is pumped from a 500′ well by a deep-well turbine pump. The bunker capacity is about 800 tons. Thirty men are employed.

OIL FIELD DEVELOPMENT OPERATIONS.

By R. D. Bush, State Oil and Gas Supervisor.

From April 3, 1927, to and including July 2, 1927, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
FRESNO COUNTY:					
Standard Oil Co.	1	20	15	238	Coalinga
Potter & Esplin	6	16	14	1	
KERN COUNTY:					
California-Kentucky Oil Co.	8	29	21	1	Belridge
Carneros Oil Co.	30	28	21	43	Belridge
Carneros Oil Co.	30	28	21	45	Belridge
Standard Oil Co.	27	28	20	Bacon 1	Belridge
Standard Oil Co.	31	30	25	Kern Co. Lease 1 26	Elk Hills
C. C. M. O. Co.	23	28	27	4	Kern River
C. C. M. O. Co.	23	28	27	5	Kern River
C. C. M. O. Co.	23	28	27	6	Kern River
General Petroleum Corp.	14	28	27	1	Kern River
General Petroleum Corp.	14	28	27	27	Kern River
General Petroleum Corp.	26	28	27	Sill 1	Kern River
General Petroleum Corp.	13	28	27	Young 51	Kern River
George F. Getty	14	28	27	Lehnhardt 9	Kern River
George F. Getty	14	28	27	Lehnhardt 10	Kern River
George F. Getty	14	28	27	Lehnhardt 11	Kern River
George F. Getty	14	28	27	Lehnhardt 12	Kern River
George F. Getty	14	28	27	Lehnhardt 20	Kern River
George F. Getty	14	28	27	Lehnhardt 21	Kern River
George F. Getty	14	28	27	Lehnhardt 22	Kern River
George F. Getty, Inc.	22	28	27	Tegeler 17	Kern River
George F. Getty, Inc.	22	28	27	Tegeler 18	Kern River
George F. Getty, Inc.	22	28	27	Tegeler 19	Kern River
George F. Getty, Inc.	22	28	27	Tegeler 22	Kern River
Standard Oil Co.	15	28	27	5	Kern River
Standard Oil Co.	15	28	27	6	Kern River
Standard Oil Co.	15	28	27	7	Kern River
Standard Oil Co.	27	28	27	7	Kern River
Standard Oil Co.	15	28	27	8	Kern River
Standard Oil Co.	27	28	27	8	Kern River
Standard Oil Co.	15	28	27	9	Kern River
Standard Oil Co.	27	28	27	9	Kern River
Standard Oil Co.	15	28	27	10	Kern River
Standard Oil Co.	11	28	27	Universal 1	Kern River
Tarr & McComb, Inc.	2	29	28	11	Kern River
Tarr & McComb, Inc.	2	29	28	12	Kern River
F. G. Wagner	34	28	28	2	Kern River
F. G. Wagner	34	28	28	4	Kern River
Wonder Co., Ltd.	23	28	27	2	Kern River
Wonder Co., Ltd.	23	28	27	14	Kern River
Ozena Oil Co.	27	29	21	1	McKittrick
C. C. M. O. Co.	22	31	22	37	Midway
Electric Petroleum Corp.	34	30	22	1	Midway
Midway Peerless Oil Co.	15	31	22	3-X	Midway
North American Oil Cons.	32	31	24	10	Midway
North American Oil Cons.	32	31	24	11	Midway
Standard Oil Co.	27	31	23	4	Midway
Standard Oil Co.	31	31	24	28	Midway
Standard Oil Co.	31	31	24	29	Midway
Standard Oil Co.	7	32	24	59	Midway
Standard Oil Co.	17	32	24	70	Midway
Standard Oil Co.	7	32	24	232	Midway
The United Oil Co.	6	31	23	Mason 5	Midway
Poso Pete Co.	32	26	28	Kathryn Hyde 1	Mt. Poso
Shell Co.	9	27	28	Vedder-Rall 3	Mt. Poso
Pacific American Oil Co.	10	11	23	Akridge 1	Sunset
Raleigh Oil Co.	8	11	23	1	Sunset

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued.					
Standard Oil Co.	31	12	23	32	Sunset
Standard Oil Co.	5	11	23	140	Sunset
M. H. Whittier Co.	1	11	24	9	Sunset
Bomke and Ball	12	29	20	Larson 1	Temblor
R. B. Jackson and J. F. Harrison	36	29	20	1	Temblor
Max L. Pray	1	29	20	2	Temblor
Elbe Oil Land Development Co.	18	28	29	2	
Elbe Oil Land Development Co.	18	28	29	3	
Elbe Oil Land Development Co.	18	28	29	4	
Elbe Oil Land Development Co.	18	28	29	5	
Elbe Oil Land Development Co.	20	28	29	6	
H. L. Whiston	20	27	29	1	
KINGS COUNTY:					
General Petroleum Corp.	26	22	18	Ochsner 2	
William Gilbert	20	23	19	Barritt 1	
William Gilbert	4	23	19	Barritt 2	
William Gilbert	28	23	19	Ogden Akst 1	
LOS ANGELES COUNTY:					
Alanson Co.	18	2	14	Phil Young, Jr. 2	Inglewood
Standard Oil Co.	17	2	14	Baldwin-Cienega 43	Inglewood
Standard Oil Co.	17	2	14	Baldwin-Cienega 44	Inglewood
Standard Oil Co.	17	2	14	L.A.Invest. 1 53	Inglewood
Standard Oil Co.	16	2	14	Baldwin-Cienega 62	Inglewood
Standard Oil Co.	16	2	14	Stocker 11	Inglewood
California Petroleum Corp.	19	4	12	Davidson 6	Long Beach
Campbell Co.	29	4	12	1	Long Beach
Davis & Macmillan Co.	19	4	12	14	Long Beach
Delaney Petroleum Corp.	29	4	12	7	Long Beach
Italo American Petroleum Corp.-Modoc Petroleum Corp.	19	4	12	Italo 4	Long Beach
Shell Co.	19	4	12	Cresson Comm. 8	Long Beach
Shell Co.	19	4	12	Cresson Comm. 9	Long Beach
Shell Co.	19	4	12	Cresson Comm. 10	Long Beach
Shell Co.	19	4	12	Cresson Comm. 11	Long Beach
Signal Syndicate No. 3	19	4	12	4	Long Beach
Travis Drilling Co.	29	4	12	Travis 1	Long Beach
Charles S. Florsheim	1	2	12	1	Montebello
Standard Oil Co.	2	2	12	Stocker-Merced 1	Montebello
Union Oil Co.	31	2	11	Howard 8	Santa Fe Springs
T. H. M. Aitken	3	5	12	Aitken 1	Seal Beach
Associated Oil Co.	11	5	12	Bryant 9	Seal Beach
Associated Oil Co.	11	5	12	Bryant 10	Seal Beach
Associated Oil Co.	11	5	12	Bryant 11	Seal Beach
Associated Oil Co.	11	5	12	Bryant 22	Seal Beach
Associated Oil Co.	11	5	12	Hellman 4	Seal Beach
Associated Oil Co.	11	5	12	Hellman 16	Seal Beach
Associated Oil Co.	11	5	12	Hellman 17	Seal Beach
Fred A. Ballin and Fred Erwing	3	5	12	2	Seal Beach
Bankline Oil Co.	3	5	12	Park 1	Seal Beach
H. J. Barneson	3	5	12	Brust & Shore 1	Seal Beach
H. J. Barneson	3	5	12	Fueller 1	Seal Beach
California American Oil Co.	3	5	12	1	Seal Beach
California Eastern Oil Co.	3	5	12	Fleming 1	Seal Beach
California-Eastern Oil Co.	3	5	12	Hodges-Wilson 1	Seal Beach
California Eastern Oil Co.	3	5	12	Judson 2	Seal Beach
California Eastern Oil Co.	3	5	12	Judson 3	Seal Beach
California Eastern Oil Co.	3	5	12	Judson 4	Seal Beach
California Eastern Oil Co.	3	5	12	Judson 5	Seal Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
California Eastern Oil Co.	3	5	12	Judson 6	Seal Beach
California Eastern Oil Co.	3	5	12	Judson 7	Seal Beach
California Eastern Oil Co.	3	5	12	Judson 8	Seal Beach
California Eastern Oil Co.	3	5	12	Judson 9	Seal Beach
California Eastern Oil Co.	3	5	12	Layden-Lampdon 1	Seal Beach
California Eastern Oil Co.	3	5	12	Parr 1	Seal Beach
California Eastern Oil Co.	3	5	12	Raymond & Larsen 1	Seal Beach
Coastal Oil Co	3	5	12	3	Seal Beach
E. L. Cragen	3	5	12	1	Seal Beach
Dill & Comstock	3	5	12	1	Seal Beach
Dill & Comstock	3	5	12	2	Seal Beach
Fred Erwing	3	5	12	1	Seal Beach
Failing & Wallace	3	5	12	1	Seal Beach
Fleet Petroleum Corp	3	5	12	11	Seal Beach
General Petroleum Corp	3	5	12	Counts 1	Seal Beach
General Petroleum Corp	3	5	12	Hemphill 1	Seal Beach
General Petroleum Corp	4	5	12	W. & W. 1	Seal Beach
General Petroleum Corp	3	5	12	Wasem 10	Seal Beach
George F. Getty, Inc	3	5	12	S. B. 10	Seal Beach
George F. Getty, Inc	3	5	12	S. B. 11	Seal Beach
George F. Getty, Inc	3	5	12	S. B. 12	Seal Beach
George F. Getty, Inc	3	5	12	S. B. 13	Seal Beach
George F. Getty, Inc	3	5	12	S. B. 14	Seal Beach
Edward B. Giffen	3	5	12	Alamitos 1	Seal Beach
Reuben R. Horwitz	3	5	12	1	Seal Beach
Italo American Petroleum Corp.	3	5	12	Italo 20	Seal Beach
Loftin Oil Co	4	5	12	Loftin 1	Seal Beach
Loftin Oil Co.	3	5	12	Outpost 1	Seal Beach
C. B. Lones	3	5	12	Jones 1	Seal Beach
Marland Oil Co.	10	5	12	McGrath & Selover 6	Seal Beach
McAlpine Petroleum Co.	3	5	12	McAlpine Alamitos 1	Seal Beach
M. W. McVey	3	5	12	Alamitos 1	Seal Beach
M. W. McVey	3	5	12	Alamitos 2	Seal Beach
Leland Mitchell	3	5	12	1	Seal Beach
John H. Peacock, Trustee	3	5	12	1	Seal Beach
Petroleum Securities Co.	3	5	12	Bott 1	Seal Beach
Petroleum Securities Co	4	5	12	Breig 1	Seal Beach
Petroleum Securities Co.	3	5	13	Brice 1	Seal Beach
Petroleum Securities Co.	35	5	12	Brisendine 1	Seal Beach
Petroleum Securities Co.	3	5	12	Bryant 1	Seal Beach
Petroleum Securities Co.	3	5	12	Bryant 2	Seal Beach
Petroleum Securities Co.	3	5	12	Bryant 3	Seal Beach
Petroleum Securities Co.	3	5	12	Bryant 4	Seal Beach
Petroleum Securities Co.	3	5	12	Bryant 5-A	Seal Beach
Petroleum Securities Co.	3	5	12	Bryant 6-A	Seal Beach
Petroleum Securities Co.	3	5	12	Bryant 7-A	Seal Beach
Petroleum Securities Co.	3	5	12	Bryant 1-B	Seal Beach
Petroleum Securities Co	3	5	12	Bryant 2-B	Seal Beach
Petroleum Securities Co	3	5	12	Dexter 1	Seal Beach
Petroleum Securities Co	3	5	12	Dotson 1	Seal Beach
Petroleum Securities Co	3	5	12	Evans Fee 1	Seal Beach
Petroleum Securities Co	3	5	12	Gleek 1	Seal Beach
Petroleum Securities Co	3	5	12	Heller 1	Seal Beach
Petroleum Securities Co.	4	5	12	Horwitz 1	Seal Beach
Petroleum Securities Co	3	5	12	James 1	Seal Beach
Petroleum Securities Co.	3	5	12	Kellas 1	Seal Beach
Petroleum Securities Co.	3	5	12	Kindig 1	Seal Beach
Petroleum Securities Co.	3	5	12	Lieberman 1	Seal Beach
Petroleum Securities Co.	3	5	12	Marquis 1	Seal Beach
Petroleum Securities Co.	3	5	12	Murphy 1	Seal Beach
Petroleum Securities Co.	3	5	12	Murphy 2	Seal Beach
Petroleum Securities Co.	3	5	12	Naples 6	Seal Beach
Petroleum Securities Co.	3	5	12	Naples 7	Seal Beach
Petroleum Securities Co.	3	5	12	Nicholson 1	Seal Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
Petroleum Securities Co.	3	5	12	Parr-Person 1	Seal Beach
Petroleum Securities Co.	3	5	12	Parr-Person 2	Seal Beach
Petroleum Securities Co.	3	5	12	Parr-Person 3	Seal Beach
Petroleum Securities Co.	3	5	12	Parr-Person 4	Seal Beach
Petroleum Securities Co.	3	5	12	Thurston 1	Seal Beach
Petroleum Securities Co.	3	5	12	Wahl 1	Seal Beach
Petroleum Securities Co.	3	5	12	Williams 1	Seal Beach
Petroleum Securities Co.	3	5	12	Williams 2	Seal Beach
W. M. Richmond	3	5	12	Richmond-Summy 1	Seal Beach
Ring Petroleum Corp.	3	5	12	10	Seal Beach
Fred W. Roberts	3	5	12	Alamitos 1	Seal Beach
Standard Oil Co.	3	5	12	San Gabriel 13	Seal Beach
Standard Oil Co.	3	5	12	San Gabriel 14	Seal Beach
Union Drilling & Petroleum Co.	3	5	12	Burge 1	Seal Beach
Union Drilling & Petroleum Co.	3	5	12	Smeeton 1	Seal Beach
Fred A. Walker	4	5	12	Byrne 1	Seal Beach
Warren and Macrate	3	5	12	Warren & Macrate 1	Seal Beach
J. G. Wheeler	3	5	12	1	Seal Beach
White Eagle Petroleum Co.	3	5	12	1	Seal Beach
White Eagle Petroleum Co.	3	5	12	2	Seal Beach
White Eagle Petroleum Co.	3	5	12	3	Seal Beach
White Eagle Petroleum Co.	3	5	12	4	Seal Beach
White Eagle Petroleum Co.	3	5	12	5	Seal Beach
White Smithson Oil Co.	3	5	12	Alamitos 1	Seal Beach
C. C. M. O. Co.	17	4	14	Del Amo 71	Torrance
C. C. M. O. Co.	17	4	14	Del Amo 76	Torrance
C. C. M. O. Co.	8	4	14	Del Amo 90	Torrance
C. C. M. O. Co.	10	4	14	Torrance 90	Torrance
J. E. O'Donnell	7	4	13	O'Donnell 58	Torrance
Associated Oil Co.	2	3	14	Johnson 1	----------
George F. Getty, Inc.	26	2	12	Marland 1	----------
Joseph Hummel	11	2	14	1	----------
R. W. and Geo. H. Jackson	8	3	14	Jackson-Leuzinger 1	----------
McCoy-Thomason Drilling Co.	27	5	16	1	----------
Shell Co.	4	2	15	Mission 1	----------
Southwest Petroleum Co.	4	3	13	Ramsaur 1	----------
Standard Oil Co.	36	1	15	Marblehead 1	----------
MERCED COUNTY:					
John E. Faber	19	6	11	1	----------
ORANGE COUNTY:					
Brea Canon Oil Co.	1	3	10	42	Brea Olinda
Chicksan Oil Co.	19	3	9	Mathis 1	Coyote Hills
General Petroleum Corp.	19	3	9	Wallop 1	Coyote Hills
Herndon & Hunter	19	3	9	Herndon 2	Coyote Hills
Holly Development Co.	20	3	9	Barnett 1	Coyote Hills
Angelus Petroleum Co.	10	6	11	Porter 1	Huntington Beach
California Petroleum Corp.	28	5	11	Buck 4	Huntington Beach
Calnan Petroleum Co.	36	5	11	1	Huntington Beach
Colonial Oil Co.	10	6	11	2	Huntington Beach
E. E. Combs	10	6	11	8	Huntington Beach
E. L. Cragen	10	6	11	1	Huntington Beach
Crudoil Co.	10	6	11	14	Huntington Beach
Crudoil Co.	10	6	11	16	Huntington Beach
J. E. Hall	10	6	11	2	Huntington Beach
J. E. Hall	10	6	11	3	Huntington Beach
J. E. Hall	10	6	11	4	Huntington Beach
J. E. Hall	10	6	11	5	Huntington Beach
Hart & Collins	10	6	11	1	Huntington Beach
C. L. Hussey	10	6	11	1	Huntington Beach
James & Price	10	6	11	Bolton 1	Huntington Beach
Kohlbush & Johnston, Inc.	10	6	11	Wold 1	Huntington Beach
Loftin Oil Co.	10	6	11	Cain 1	Huntington Beach
Merritt Annex Oil Co.	27	5	11	Lindner 1	Huntington Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
ORANGE COUNTY—Continued.					
John J. Mullin	10	6	11	Nevada 3	Huntington Beach
Pacific Coast Oil Co.	10	6	11	2	Huntington Beach
Petroleum Securities Co	13	6	11	Mills 1	Huntington Beach
Fred W. Roberts	10	6	11	H. B. 5	Huntington Beach
W. W. Stabler	10	6	11	McClure 1	Huntington Beach
Standard Oil Co	10	6	11	P. E. 8	Huntington Beach
Standard Oil Co.	10	6	11	P. E. 9	Huntington Beach
Standard Oil Co.	10	6	11	P. E. 10	Huntington Beach
Standard Oil Co	10	6	11	P. E. 11	Huntington Beach
Standard Oil Co.	10	6	11	P. E. 12	Huntington Beach
Standard Oil Co.	10	6	11	P. E. 13	Huntington Beach
Superior Oil Co.	10	6	11	Berry 1	Huntington Beach
Superior Oil Co.	10	6	11	Groves 1	Huntington Beach
Superior Oil Co	10	6	11	Ruby Jones 1	Huntington Beach
Texas Holding Co	2	6	11	4	Huntington Beach
W. B. Thompson	10	6	11	Thompson 2	Huntington Beach
Treat Petroleum Corp	10	6	11	1	Huntington Beach
Frances H. Upman	11	6	11	Heela 1	Huntington Beac
Wellington Oil Co	2	6	11	3	Huntington Beach
World Petroleum Corp	10	6	11	Mathews & Berman 5	Huntington Beach
World Petroleum Corp.	10	6	11	Mathews & Berman 6	Huntington Beach
Associated Oil Co.	33	3	9	Kammerer 6	Richfield
California Petroleum Corp.	32	3	9	Bradford 6	Richfield
California Petroleum Corp.	33	3	9	Heartwell 2	Richfield
California Petroleum Corp.	33	3	9	Krug 9	Richfield
California Petroleum Corp.	34	3	9	Richfield Cons. 15	Richfield
General Petroleum Corp.	33	3	9	Pedeco 1	Richfield
General Petroleum Corp.	33	3	9	Pedeco 2	Richfield
George W. Johnson	27	3	9	Swain 1	Richfield
Nugent Drilling Co	27	3	9	2	Richfield
Shell Co	31	3	9	Peter J. Allec 1	Richfield
Signal Syndicate No. 4	33	3	9	6	Richfield
Standard Oil Co	34	3	9	Son-Crail-Locke 1	Richfield
Standard Oil Co.	34	3	9	L. Vejar 1	Richfield
Standard Oil Co.	34	3	9	L. Vejar 2	Richfield
Standard Oil Co.	27	3	9	Yorba Linda Water Co. 1	Richfield
Union Oil Co.	33	3	9	Stern 9	Richfield
Union Oil Co.	33	3	9	Stern 10	Richfield
Union Oil Co.	34	3	9	Yorba Linda Group 13	Richfield
O. K. Carr	13	8	8	1	
Standard Oil Co.	17	4	9	Zaiser-Brelje 1	
Tower and Olsen	3	6	10	1	
RIVERSIDE COUNTY:					
Hemet Petroleum Corp.	10	5	1	1	
SAN BENITO COUNTY:					
Homestake Oil Co	14	17	11	4	
SAN BERNARDINO COUNTY:					
Lamona Oil Assn.	21	2	8	Vizio 1	
Summit Oil Co	20	3	5	1	
SAN LUIS OBISPO COUNTY:					
San Luis Syndicate		31	13	1	Arroyo Grande
Trustees Well	25	32	14	1	
SANTA BARBARA COUNTY:					
Palmer Union Oil Co	30	9	32	Stendel 12-A	Cat Canyon
Palmer Union Oil Co.	30	9	32	Stendel 13-A	Cat Canyon
Miley Oil Co	3	4	29	Goleta 1-A	Goleta
Barnsdall Oil Co	36	4	30	Edwards 1	Goleta

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
SANTA BARBARA COUNTY—Cont.					
Berry Oil Co.	1	4	29	Cavalletto 1	Goleta
Berry Oil Co.	1	4	29	Palmetto 1	Goleta
California Eastern Oil Co.	3	4	29	Doty 1	Goleta
Graham-Loftus Oil Co.	36	5	31	1	Goleta
Miley Oil Co.	3	4	29	Goleta 4	Goleta
Miley Oil Co.	3	4	29	Goleta 5	Goleta
Miley Oil Co.	4	4	29	Goleta 7	Goleta
Levi Smith	3	4	29	2-A	Goleta
Smith & Barmore	--	4	26	5	Summerland
Smith & Barmore	--	4	26	6	Summerland
Smith & Barmore	--	4	26	7	Summerland
Smith & Barmore	--	4	26	8	Summerland
Smith & Barmore	--	4	26	9	Summerland
Smith & Barmore	--	4	26	10	Summerland
SANTA CLARA COUNTY:					
Continental Oil Co.	31	11	4	1	Sargent
W. H. Lingenfelter	8	9	1	1	----------
SOLANO COUNTY:					
H. Rambke	17	7	1	1	----------
H. Rambke	22	7	1	1	----------
SONOMA COUNTY:					
Shell Co.	14	5	7	Ielmorini 1	----------
TULARE COUNTY:					
A. Otis Birch	13	21	26	Baker 1	----------
VENTURA COUNTY:					
Santa Fe Petroleum Co.	17	4	18	Fleisher 1	Piru
Wheeler Canon Oil Co.	25	4	22	17	Santa Paula
Little Sespe Economic Oil Corp.	5	4	19	Dixie 4	Sespe
Oak Ridge Oil Co.	18	3	20	Willard 22	South Mountain
Associated Oil Co.	22	3	23	Hartman 10	Ventura
Associated Oil Co.	27	3	23	Lloyd 51	Ventura
Associated Oil Co.	23	3	23	McGonigle 4	Ventura
C. C. M. O. Co.	8	3	24	1	Ventura
C. C. M. O. Co.	17	3	24	State 1	Ventura
McBride & Rogers	21	3	23	Ventura 1	Ventura
Shell Co.	28	3	23	Edison 17	Ventura
Shell Co.	28	3	23	Edison 18	Ventura

SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff and others are published in each number of 'Mining in California.'

These special articles cover a wide range of subjects, both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

The law governing the licensing of dealers in gold-silver ores and bullion which originally became effective July 24, 1925, was revised and amended at the forty-seventh session of the legislature, in 1927. The text of the amended act now in force, commonly known as the High Grade Law, is given herewith:

ORE BUYERS LICENSE ACT,

commonly referred to as

"THE HIGH GRADE LAW."

Chapter 70, Statutes 1925, Amended 1927.

An act to provide for the regulation, control and licensing of any person, firm or corporation, engaged in the business of milling, sampling, concentrating, reducing, refining, purchasing or receiving for sale ores, concentrates, or amalgams, bearing gold or silver, gold dust, silver or gold bullion, nuggets or specimens; to provide rules and regulations therefor; and to provide penalties for the violation of the provisions of this act.

SECTION 1. Hereafter it shall be unlawful for any person, firm, association or corporation without first procuring the license herein provided for, to engage in the business of milling, sampling, concentrating, reducing, refining, purchasing or receiving for sale ores, concentrates, or amalgams bearing gold or silver, gold dust, gold or silver bullion, nuggets or specimens. Every person, firm, association, or corporation engaged in such business shall pay a license tax of twenty-five dollars per annum to the State of California. No license shall be granted to any person, firm or association unless such person and the members of such firm or association shall be bona fide residents of the State of California, and no license shall be granted to any joint stock company or corporation organized under the laws of any other state or foreign country unless such company or corporation has complied with all the laws of this state relating to the qualifications of foreign corporations to do business in this state; *provided*, that this section shall not be construed

as requiring a license for any mill, sampler, concentration or reduction plant used exclusively by the owner in sampling, milling, reducing or concentrating ores produced by such owner.

SEC. 2. The application for license to carry on such business must be made to the state mineralogist of the State of California, and shall contain the full names and addresses of applicants, if natural persons, and in the case of firms and associations the full names and addresses of the members thereof, and in the case of corporations, the full names and addresses of the officers and directors thereof, and the place or places where such business is to be carried on. Such application shall be sworn to by the person making it. Every license granted shall date from the first day of the month in which it is issued and expire on the thirty-first day of the following December, and such license or copies thereof shall be kept conspicuously displayed in the place or places of business of the licensee within the State of California. Every application shall be filed not less than thirty days prior to the granting of such license, and notice of the filing of such application shall be posted in the office of said state mineralogist and be published at the cost of the applicant once a week for three successive weeks in a newspaper published in the county or counties where such business is to be carried on. Protest may be made by any person to the issuing of such license, and when such protests are filed with the state mineralogist, the latter shall give notice of and hold a public hearing upon said protest before issuing such license. The said state mineralogist shall have the power to reject any application or license after a hearing upon such protest as aforesaid, and he shall also have power to revoke any license for failure on the part of the licensee to observe this act or any part thereof, or when the licensee shall have violated the provision or provisions of any law of the State of California relating to ore buying or of any law of said state relating to larceny or receiving stolen property; *provided,* that no license shall be revoked except upon written charges filed by two or more reputable persons as accusers, specifying the violations of law for which revocation is sought, and after a public hearing as in case of protests against the granting of licenses. An application for a review of any order granting, refusing, or revoking, a license made by the state mineralogist under this act, may be made to the superior court in and for the county where the aggrieved parties reside, by any person or persons who may feel aggrieved by such order and whose name or names appear in the record of the proceedings before the state mineralogist as a licensee, applicant for license, protestant, or accuser, by lodging in the office of the clerk of said court a certified copy of the transcript of the proceedings before the state mineralogist, including copies of all papers filed therein. The transcript shall be accompanied by a short petition naming the person or persons applying for the review as plaintiff or plaintiffs and the state mineralogist as defendant, and praying for a review of the order.

Within ten days after lodging such application the party or parties applying for the review shall serve notice of its pendency upon the state mineralogist, in writing, and if the review be of an order granting a license or refusing to revoke a license, such notice shall also be served upon the person to whom the license was thereby granted or whose license was thereby permitted to remain in force.

Such notice may be served by personal delivery or by registered mail, and proof of service shall be made to the satisfaction of the court if not admitted. No review shall be allowed unless taken within thirty days after entry of the order. The said court shall try all such reviews upon the transcript, and such evidence as may be offered and admitted. When the court has finally determined any such proceeding, it shall forthwith cause its order in the premises to be certified to the state mineralogist. The costs in such review shall be awarded at the discretion of the court, and if any costs are awarded against the state mineralogist, the same shall be paid out of funds arising from the payment of license fees under this act. When a review is had, as herein provided, of an order of the state mineralogist revoking a license, such review shall operate as a stay upon such order.

For the making of the transcript herein provided for, the state mineralogist shall collect from the person or persons ordering the same, twenty-five cents per folio of one hundred words, and twenty-five cents for certifying the same.

The superior court in and for the county or city and county in which the aggrieved party or parties reside shall have the right and jurisdiction to review the action of the state mineralogist in granting, refusing, or revoking a license.

SEC. 3. Each application shall be accompanied by a bond to be approved by the said state mineralogist to the people of the State of California in the penal sum of three thousand dollars ($3,000), with two or more sufficient sureties or by a surety company duly authorized to do business in this state, and conditioned that the obligor will not violate any law applicable to such business. If any person shall be aggrieved by the misconduct of any such licensee through his violation of any law relating to such business, and shall recover a judgment therefor, such person may, after a return unsatisfied in whole or in part of any execution issued upon said judgment, maintain an action in his own name upon such bond herein required in any court of competent jurisdiction. The state mineralogist shall furnish to any one applying therefor a certified copy of any such bond filed with him, upon the payment of a fee of twenty-five cents, and such certified copy shall be prima facie evidence in any court that such bond was duly executed and delivered by each person whose name appears thereon. Said bond shall be renewed and refiled prior to the date of its expiration, or the licensee shall, within thirty days thereafter, cease doing business, and his license shall be revoked by said state mineralogist; but said bond until renewed and refiled, shall remain in full force and effect for a period of three years from the time of approval thereof by the state mineralogist.

SEC. 4. Every person, firm, association or corporation, carrying on such business, shall keep and preserve a book in which shall be entered at the time of the delivery of any ores, concentrates or amalgams, bearing gold or silver, gold dust, gold or silver bullion, nuggets or specimens:

First—The name of the party on whose behalf such ores, concentrates, gold dust, gold or silver bullion, nuggets or specimens are delivered;

Second—The weight, or amount, and a short description of each lot thereof;

Third—The name and location of the mine or claim from which it shall be stated that the same has been mined or procured;

Fourth—The name of the party delivering the same;

Fifth—The date of delivery; and

Sixth—Whether the party making the delivery is a lessee, superintendent, foreman, or workman in such mine.

Such book shall be open for inspection to the state mineralogist, his deputies, officers, and agents, on every day except Sundays and legal holidays, between the hours of nine o'clock in the forenoon and five o'clock in the afternoon. If any person, on his own behalf or being duly authorized thereunto by another, shall make and file with the said state mineralogist an affidavit stating that to his best knowledge and belief he or his principals, as the case may be, has, within the three months next preceding the filing of such affidavit, sustained a loss of any of the above described property, by theft or trespass, and that he believes that such property was delivered to a licensee under this act, naming such licensee, the state mineralogist shall forthwith issue a permit to such person to examine the book kept by such licensee under this act; and upon the presentation of such permit to such licensee, such person shall have the right to inspect and examine the entries made in said book during said period of three months, on the same terms and conditions as the state mineralogist.

SEC. 4*a*. The state mineralogist shall prescribe the form and contents of all reports in order to comply with section 4 of this act and it shall be the duty of every person, firm, association or corporation to file monthly with the state mineralogist a report of all purchases made under the provisions of this act. Any licensee who shall fail or refuse to comply with the provisions of this act shall be deemed guilty of a misdemeanor.

SEC. 5. Any licensee under this act who shall fail, or neglect or refuse to keep and preserve the book herein provided for, shall forfeit his license and shall in addition, upon conviction, be liable to the penalties provided in section 8 of this act. Any licensee or other person who shall knowingly make any false entries upon such book, or knowingly enter or cause to be entered upon the same any false or fictitious names, shall upon conviction, be liable to the penalties provided in section 8 of this act. Any licensee who shall refuse to permit any person duly authorized as herein provided to inspect said book or the entries therein, shall, on conviction, be liable to the penalties provided for a violation of this act and shall forfeit his license.

SEC. 6. Any person who shall knowingly make any false statements concerning any of the facts required to be stated in section 4 of this act shall be guilty of a misdemeanor.

SEC. 7. Complaints against any licensee or applicant shall be made in writing to said state mineralogist, and reasonable notice thereof, not less than three days, shall be given to said licensee or applicant by serving upon him a copy of such complaint, and a hearing shall be had before the said state mineralogist within one week from the date of the filing of the complaint, and no adjournment shall be taken for longer than one week. A daily calendar shall be kept of all hearings by said state mineralogist, which shall be posted in a conspicuous place in his public office for at least three days before the date of such hearing.

The said state mineralogist shall keep a record of all such complaints and hearings, and may refuse to issue and shall suspend or revoke any license for any good cause shown, within the meaning and purpose of this act; and when it is shown that any licensee or applicant under this act, either before or after conviction, is guilty of any conduct in violation of this or any law relating to such business, it shall be the duty of the said state mineralogist of the State of California to suspend, revoke or reject the license of such licensee or applicant, but notice of the proposed action shall be presented to and reasonable opportunity shall be given licensee or applicant to be heard in his defense. Whenever for any reason such license is revoked, said state mineralogist shall not issue another license to said licensee until the expiration of at least one year from the date of revocation of such license. The state mineralogist shall decide all matters submitted to him within thirty days from the time he takes them under advisement.

SEC. 8. Any violation of sections 1, 4, 4*a* and 5 of this act shall be punishable by a fine of not less than one hundred dollars and not more than one thousand dollars, or by imprisonment in the county jail for not less than thirty days nor more than six months, or both such fine and imprisonment. The state mineralogist shall notify the district attorney of the county in which the offense occurs of such violation, and the said district attorney shall institute criminal proceedings for the enforcement of this act before any court of competent jurisdiction.

SEC. 9. The expenses of the state mineralogist arising out of this act shall be defrayed out of the moneys paid in from time to time for licenses issued hereunder. Any balance remaining in the hands of said state mineralogist on the thirty-first day of December of each year, derived through this act shall be turned over to the general fund of the state.

SEC. 10. Should the duties of the state mineralogist be transferred to a director or department of mines and mineral resources, all of the powers, rights, duties and responsibilities of the state mineralogist provided in this act shall be thereby transferred to such director or department of mines and mineral resources.

SEC. 11. If any section, sentence, clause or phrase of this act is for any reason held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this act. The legislature hereby declares that it would have passed this act and each sentence, clause and phrase thereof, irrespective of the fact that any one or more of the sections, sentences, clauses or phrases be declared unconstitutional.

ADMINISTRATIVE DIVISION.

WALTER W. BRADLEY, Deputy State Mineralogist.

Personnel.

There have been no changes of personnel to be noted during the past quarter.

New Publications.

During the quarterly period covered by this issue, the following Bureau publications have been made available for distribution:

Mining in California (quarterly), January, 1927, being Chapter 1 of State Mineralogist's Report XXIII. Price 25 cents. This chapter contains reports on the mineral resources of Contra Costa County and of Santa Catalina Island; also a reprint of the report of the Hydraulic Mining Commission (including the map).

Summary of Operations, California Oil Fields: Vol. 12, No. 6, December, 1926, and Nos. 7 and 8, January and February, 1927, respectively.

Commercial Mineral Notes: Nos. 50, 51, 52, May-July (incl). These 'notes' carry the list of 'mineral deposits wanted' and 'minerals for sale' issued in the form of a mimeographed sheet monthly. It is mailed free to those on the mailing list for 'Mining in California.'

Mails and Files.

The Bureau maintains, in addition to its correspondence files and the library, a mine file which includes original reports on the various mines and mineral properties of all kinds in California.

During the period covered by this quarterly report, there were 1545 letters received and answered at the San Francisco office alone, covering almost every phase of prospecting, mining, and developing mineral deposits, reduction problems, marketing of refined products, and mining law.

DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum, Laboratory.

WALTER W. BRADLEY, Deputy State Mineralogist.

STATISTICS.

Data on the 1926 production of several of California's minerals were given in the April issue of MINING IN CALIFORNIA, and some additional ones are presented herein. Copy of the complete annual report for the year is now being prepared and will shortly go to the printer as Bulletin No. 100 of the State Mining Bureau.

COPPER.

Copper is second only to gold among the metals produced in California. The output for 1926 amounted to a total of 33,521,544 pounds of recoverable metal valued at $4,693,014, a decrease from the 1925 figures of 46,968,499 pounds and $6,669,527. The average price was slightly lower (14.0¢ per pound against 14.2¢) than in 1925. The 1924 price was 13.1¢ per pound.

As for several years past, Plumas County ranked first for 1926, with an output of 22,163,035 pounds; Calaveras, second, with 5,240,927 pounds; and Shasta, third, with 5,113,114 pounds; Shasta and Calaveras changing places compared with their 1925 positions.

Distribution of the 1926 copper output by counties was as follows:

County	*Pounds*	*Value*
Calaveras	5,240,927	$733,730
Inyo	42,462	5,945
Mono	2,628	368
Plumas	22,163,035	3,102,825
Riverside	22,125	3,096
San Bernardino	171,232	23,972
Shasta	5,113,114	715,836
Trinity	760,140	106,420
Amador, Mariposa, Napa, Nevada, Orange, San Diego, Tuolumne *	5,881	822
Totals	33,521,544	$4,693,014

* Combined to conceal output of a single operator in each.

GOLD.

The production of gold in California in 1926 totaled 576,798.40 fine ounces, worth $11,923,481, being a decrease of 55,236.91 fine ounces from the 1925 yield. The 'deep' or lode mines accounted for $6,695,078, and the placers (mainly the dredgers) produced $5,228,403. As the State Mining Bureau has never independently gathered the statistics of gold and silver production, these figures, as in former years, are published by cooperation with and through the courtesy of Mr. J. M. Hill of the Division of Minerals and Statistics, U. S. Bureau of Mines.

The largest gold production for 1925 is reported from Yuba County with an output of 133,984.39 fine ounces ($2,769,703); Nevada County with 112,174.19 ounces ($2,318,846) was second; Amador County, 104,841.95 ounces ($2,167,275), third; Sacramento County, 63,083.24 ounces ($1,304,046), fourth; followed by Calaveras and Sierra counties in fifth and sixth places, respectively. It will be noted that Yuba County retained its position of first place, and that Nevada and Amador exchanged second and third, compared with the 1925 standing. The

Yuba County production is almost entirely from dredges, while that from Nevada and Amador is mainly lode gold.

Gold Production, by Counties, 1926.

County	*Value*	*County*	*Value*
Amador	$2,167,275	Nevada	$2,318,846
Butte	287,853	Orange	60
Calaveras	576,889	Placer	82,921
Del Norte	1,078	Plumas	247,667
El Dorado	91,789	Riverside	2,931
Fresno	8,595	Sacramento	1,304,046
Humboldt	1,243	San Bernardino	106,875
Imperial	238	San Diego	10,543
Inyo	26,871	Santa Cruz	143
Kern	135,508	Shasta	132,906
Lassen	67	Sierra	564,452
Los Angeles	94	Siskiyou	141,240
Madera	1,708	Stanislaus	127,398
Mariposa	182,313	Trinity	483,471
Modoc	158	Tuolumne	119,873
Mono	20,204	Yuba	2,769,703
Monterey	706		
Napa	7,817	Total value	$11,923,481

LEAD.

Production of lead in California in 1926 increased slightly both in quantity and value over the preceding year. As in the past, the principal output was from lead-silver ores in Inyo County. The total recoverable lead in ores shipped from Californian mines in 1926 amounted to 8,067,873 pounds, valued at $645,429, as against 7,352,422 pounds and $639,661 in 1925. The average price of lead in 1926 was 8.0¢ per pound compared to 8.7¢ in 1925 and 8.0¢ in 1924.

The 1926 production was distributed by counties as follows:

Lead Production, by Counties, 1926.

County	*Pounds*	*Value*
Amador	1,267	$101
Inyo	6,541,741	523,339
Los Angeles	1,104,507	88,361
Mono	20,906	1,672
Nevada	4,301	344
Orange	5,176	414
Riverside	173,207	13,857
San Bernardino	195,536	15,643
Shasta	15,584	1,247
Calaveras, Imperial, Plumas, San Diego, Siskiyou, Tuolumne*	5,648	451
Totals	8,067,873	$645,429

* Combined to conceal output of a single operator in each.

PETROLEUM.

The crude oil production of California for 1925 amounted to a total of 224,673,281 barrels of clean oil, valued at $345,546,677 at the well. This total of quantity is compiled from the monthly production reports filed by the operators with the State Oil and Gas Supervisor, to which have been added figures for the output of a number of small operators in the old Los Angeles City Field not under the jurisdiction of the Supervisor, and a small production in San Mateo County which was also not reported to that office.

The question of the value of the crude oil yield at the well is a difficult one to settle with exactitude, principally because a large part of the output is not sold until after refining. The large refiners are also large producers of crude oil which they send direct from well to plant, hence

much of the crude oil is not sold as such. The values used in the statistical reports of the State Mining Bureau since 1914 have been derived from averages of actual sales of crude oil of all grades in each field of the state, and these averages applied to the total yield of the respective fields. This we feel is a safer measure of commercial values than market quotations, because quotations do not always mean sales. This is particularly true on a rising or a falling market.

The following table gives the production and value by counties for 1926 compared with the 1925 figures:

	1925		1926	
County	*Barrels*	*Value*	*Barrels*	*Value*
Fresno	7,773,665	$8,503,390	7,340,102	$5,982,183
Kern	58,852,742	84,255,094	54,549,646	78,987,887
Los Angeles	121,214,551	173,215,593	105,826,337	174,084,324
Orange	32,734,420	46,384,673	37,989,349	59,225,395
San Luis Obispo	29,590	32,164	27,982	22,162
Santa Barbara	2,647,380	2,419,705	1,925,204	1,526,587
Santa Clara	13,828	22,594	[b]	[b]
Ventura	9,221,846	15,769,357	16,994,275	25,695,344
San Bernardino, and San Mateo	[a]4,125	7,259		
Kings, San Bernardino, San Mateo, Santa Clara, Sonoma [b]			[b]20,386	22,795
Totals	232,492,147	$330,609,829	224,673,281	$345,546,677

[a] Combined to conceal output of a single operator in San Bernardino County.
[b] Combined to conceal output of a single operator in each.

The foregoing totals show a state average price of $1.538 per barrel for the year 1926, as compared to $1.422 in 1925 and $1.200 in 1924.

Oil in 'Storage.'

Field, refinery, pipe-line, and tank-farm stocks of crude and refinery products in Pacific Coast territory totaled 145,612,176 barrels,[1] December 31, 1926, compared with 157,316,309 barrels on December 31, 1925. Of the 11,704,133 barrels decrease during the year, 8,214,864 barrels of tank-farm oils were destroyed by fire.

Stocks	*Dec. 31, 1926 (Barrels)*	*Dec. 31, 1925 (Barrels) (Revised)*
Heavy crude, heavier than 20° A.P.I., including all grades of fuel	88,707,499	86,519,383
Refinable crude, 20° A.P.I., and lighter	30,835,057	44,196,138
Gasoline	11,673,563	10,172,562
Naphtha distillates	3,832,042	6,548,483
All other stocks	10,564,015	9,879,743
Totals, all stocks	145,612,176	157,316,309

Proved Oil Land.

The total proved oil land of the state is 121,435 acres, a decrease during 1926 of one acre. Of this 1926 total, 22,493 acres, being owned by Federal, state and city governments, or for other reasons, is not assessable for the support of the Department of Petroleum and Gas of the State Mining Bureau. The acreage in 1926 was distributed by counties as follows:

[1] Standard Oil Bulletin, February, 1927, p. 15.

Proved Oil Lands and Number of Wells, 1926.

County	*Land (Acres)*	*Number wells Dec. 31, 1926*
Fresno	14,665	931
Kern	77,502	5,309
Los Angels *	10,041	2,976
Orange	6,536	1,165
San Luis Obispo	402	18
Santa Barbara	7,394	291
Santa Clara	80	9
Ventura	4,815	579
Kings, San Bernardino, San Mateo, Sonoma		3
Totals	121,435	11,281

*Not including the old Los Angeles City Field.

SILVER.

Except for the early-day production from the silver mines of the Calico district and the more recent production from those of the Randsburg area, both of which are in San Bernardino County, the recovery of silver in California has been largely as a by-product from its association with copper, lead, zinc, and gold ores.

The 1926 silver output of California totaled 2,022,460 fine ounces, valued at $1,262,015, compared with 3,054,416 fine ounces, valued at $2,106,871, in 1925. Of the 1926 yield, $12,082 was from placers. The average price of domestic silver during 1926 was 62.4¢ per ounce in New York, as against 69.4¢ in 1925. The figures below are those of the U. S. Bureau of Mines, Department of Commerce (as explained under Gold).

The distribution of the 1926 silver yield by counties was as follows:

Silver Production, by Counties, 1926.

County	*Fine ounces*	*Value*
Amador	21,510	$13,422
Butte	4,803	2,997
Calaveras	9,983	6,229
Del Norte	6	4
El Dorado	756	472
Fresno	84	52
Humboldt	10	6
Imperial	31	19
Invo	124,508	77,693
Kern	7,479	4,667
Lassen	1	1
Los Angeles	68,362	42,658
Madera	35	22
Mariposa	2,433	1,518
Modoc	5	3
Mono	194,557	121,404
Monterey	5	3
Napa	81,116	50,616
Nevada	48,101	30,015
Orange	1,550	967
Placer	554	346
Plumas	347,147	216,620
Riverside	5,024	3,135
Sacramento	2,607	1,627
San Bernardino	884,045	551,644
San Diego	545	340
Santa Cruz	1	1
Shasta	177,434	110,719
Sierra	4,669	2,913
Siskiyou	1,137	709
Stanislaus	659	411
Trinity	21,275	13,276
Tuolumne	1,793	1,119
Yuba	10,235	6,387
Totals	2,022,460	$1,262,015

ZINC.

Recoverable zinc in ores mined in California in 1926 amounted to 20,447,559 pounds, valued at $1,533,568, compared with 11,546,602 pounds and $877,542 in 1925. The bulk of the 1926 product came from Shasta and Los Angeles (Santa Catalina Island) counties and was shipped in the form of concentrates to Belgium. A portion of the output is used locally in the manufacture of lithopone, and a small amount of oxide is also made. The world situation as regards zinc was particularly favorable in 1926 to the American producer, and promises to continue so.

The average price per pound quoted for the metal in 1926 was 7.5¢, as against 7.6¢ in 1925 and 6.5¢ in 1924.

MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections in North America; and contains not only specimens of most of the known minerals found in California, but much valuable and interesting material from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well as by those who utilize the facilities of the collection.

The exhibit is daily visited by engineers, students, business men and prospectors as well as tourists and mere sightseers. Besides its practical use in the economic development of California's mineral resources, the collection is a most valuable educational asset to the state and to San Francisco.

LABORATORY.

FRANK SANBORN, Mineral Technologist.

The public is earnestly invited to send such samples of minerals to this laboratory as may seem to have an economic or scientific value. The work is carried on without cost to residents of this state, and it is by means of these finds that the mineral wealth of the state is revealed. The possibilities of discovery of mineral of commercial value within the state are exceptionally favorable, and that the number of prospectors is on the increase is evidenced by the fact that the number of samples submitted to the bureau is steadily growing.

On account of the large number of samples received in the laboratory each day, it is necessary to make the reports brief. However, those who think that they may have a mineral deposit possessing commercial possibilities and who do not thoroughly understand what procedure should be taken in commercializing their prospect, are invited to ask any questions bearing on the subject.

During the three-month period covered by this report, 1157 samples were received and determined. Among this number there were considerable having commercial possibilities, judging from the samples received.

LIBRARY.

E. A. Lowe, Librarian.

In addition to the numerous standard works, authorative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the State Mining Bureau contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the State are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

OFFICIAL PUBLICATIONS RECEIVED.

Governmental.

U. S. Geological Survey:

Bulletin 786-B—Geology of the Cat Creek and Devil's Basin Oil Fields and Adjacent Areas in Montana. By Frank Reeves.

Bulletin 789—The Iniskin-Chinitna Peninsula and the Snug Harbor District, Alaska. By Fred H. Moffitt.

Bulletin 791—Geology of the Upper Matanuska Valley, Alaska. By Stephen R. Capps. Section on the Igneous Rocks. By J. B. Mertie, Jr.

Bulletin 792-A—Mineral Industry of Alaska, 1925, and Administration Report by Fred H. Moffitt.

Bulletin 792-B—Geology of the Knik-Matanuska District of Alaska. By Kenneth K. Landes.

795-A—Manganese Bearing Deposits near Lake Crescent and Humptulips, Washington. By J. T. Pardee.

795-B—Potash Brines in the Great Salt Lake Desert, Utah. By Thomas B. Nolon.

Bulletin 795-C—Organic Precipitation of Metallic Copper. By T. S. Lovering.

Professional Paper 148—Geology and Ore Deposits of the Leadville Mining District, Colorado, and maps accompanying same.

Water Supply Paper 549—Surface Water Supply of the United States, 1922, Part IX, Colorado River Basin.

Water Supply Paper 551—Surface Water Supply of the United States, 1922, Part XI, Pacific Slope Basin in California.

Water Supply Paper 557—Large Springs in the United States. By Oscar Edward Meinzer.

Water Supply Paper 575—Surface Water Supply of Hawaii, July 1, 1922, to June 30, 1923.

Water Supply Paper 584—Surface Water Supply of the United States, 1924, Part IV, St. Lawrence River Basin.

Water Supply Paper 580—Contributions to the Hydrology of the United States, 1926.
Water Supply Paper 583—Part III. Ohio River Basin.
Water Supply Paper 568—Part VIII. Western Gulf of Mexico Basins.
Water Supply Paper 569—Part IX. Colorado River Basin.
Water Supply Paper 596 A—Methods of Exploring and Repairing Leaky Artesian Wells.
Water Supply Paper 596-B—Quality of Water of Colorado River in 1925-1926.

U. S. Bureau of Mines:

Bulletin 259—Placer Mining Methods and Costs in Alaska. By Norman L. Wimler.
Bulletin 261—Resistance of Metal Mine Airway. By A. S. Richardson and G. E. McElroy.
Bulletin 267—Acid Processes for the Extraction of Alumina. By G. S. Tilley, R. W. Millar and O. C. Ralston.
Bulletin 268—Coal Dust Explosion Tests in the Experimental Mine, 1919-1924, inclusive. By George S. Rice, J. W. Paul and H. P. Greenwald.
Bulletin 269—Quarry Problems in the Lime Industry. By Oliver Bowles and W. M. Myers.
Bulletin 270—Production of Sponge Iron. By C. E. Williams, E. P. Barrett and B. M. Larsen.
Bulletin 238—Subsidence Due to Coal Mining in Illinois. By C. A. Herbert and J. J. Rutledge.
Technical Paper 391—Iron Blast Furnace Reactions. By S. P. Kinney, P. H. Royster and T. L. Joseph.
Technical Paper 404—Identification of Oil-Field Waters by Chemical Analysis. By C. E. Reistle, Jr.
Technical Paper 412—Accidents at Metallurgical Works in the United States during the Calendar Year 1925. By Wm. W. Adams.

Mineral Resources of the United States:

Zinc in 1925 (Smelter Report). By Amy Stoll.
Copper in 1925. By C. E. Julihn and Helena M. Meyer.
Petroleum in 1925. By G. R. Hopkins and A. B. Coons.
Cement in 1925. By B. W. Bagley.
Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1925. Mine Report. By James M. Hill.
Coke and By-products in 1924. By F. C. Tryon and others. With a Report on the Marketing of Coal Products. By R. S. McBride.
Gold, Silver, Copper, Lead and Zinc in Idaho and Washington in 1925. Mine Report by C. M. Gerry.
Summary of Mineral Production in Foreign Countries, 1920-24. By L. M. Jones.
Fullers Earth in 1925. By Jefferson Middleton.
Sulphur and Pyrites. By Helena M. Meyer.
Gold, Silver, Copper, Lead and Zinc in Arizona in 1925. Mine Report by V. C. Heikes.
Part I. Metals, 1925.
Part II. Nonmetals, 1925.
Statistical Summary of the California Petroleum Industry, 1926. By E. T. Knudsen and J. W. Mashal.
Petroleum Refineries in the United States, Jan. 1, 1927. By G. R. Hopkins.

U. S. Coast and Geodetic Survey: Seismological Report, October, November, December, 1925, and Supplement for 1924.

U. S. National Museum: Bulletin 131. The Minerals of Idaho. By Earl V. Shannon.

California Fish and Game Law, April, 1927.

California Libraries, News Notes of, April, 1927.

Colorado Bureau of Mines, Annual Report of Year 1926.

Connecticut, State of: Public Document No. 47.

Florida Geological Survey: 17th Annual Report. Administrative Report Mineral Industries. History of Soil Investigations in Florida. Elevations in Florida. Structure and Stratigraphy of Florida.

Idaho Bureau of Mines and Geology:

Pamphlet No. 22. The Geology and Ore Deposits of the South Mountain Mining District, Owyhee, Idaho.
26th Annual Report of the Mining Industry of Idaho, 1924.
28th Annual Report of the Mining Industry of Idaho, 1926.

Illinois Geological Survey:

Report of Investigations No. 12, Limestone for Sewage Filter Beds.
Press Bulletin No. 9, Illinois Petroleum.
Directory of Illinois Operators to Accompany Mineral Industry Map, Jan. 1, 1927. Compiled by H. P. Christensen and E. Erb.

Kansas State Geological Survey:

Bulletin 10—Part I, the Geology of Russell County, Kansas, with Special Reference to Oil and Gas Resources. By W. W. Rubey and N. W. Bass.
Bulletin 10—Part II, Subsurface Correlation of the Stratigraphic Units from Russell County to Marin County. By M. N. Bramlette.
Bulletin 10—Part III, Fossils from Wells in Central Kansas. By Raymond C. Moore.
Bulletin 11—Geological Investigations in Western Kansas, with Special Reference to Oil and Gas Possibilities. By N. W. Bass.

Kentucky Geological Survey: Kentucky's Mineral Resources, 1927.

New York State Museum: Bulletin No. 273, 1927. The Mining and Quarry Industries from 1919 to 1924, including list of Operators.

North Carolina Department of Conservation and Development:

Economic Paper 58—Oil Prospecting Well Near Havelock.
Economic Paper 59—Oil-Bearing Shales of Deep River Valley.
Circular 16—The Power Situation in North Carolina, 1925.

Virginia Conservation and Development Commission, Geological Survey: Bulletin 27—Oil and Gas Possibilities at Early Grove, Scott County, Virginia. By Chas. Butts.

Societies and Educational Institutions.

Academy of Natural Sciences of Philadelphia, Pennsylvania, Year Book.

American Mineralogist, The—Journal of the Mineralogical Society of America: Vol. 12, May, No. 5; June, No. 6; July, No. 7.

Applied American Philosophical Society, Proceedings of the—Held at Philadelphia for the Promotion of Useful Knowledge, Vol. LXV, 1926. No. 5 Supplement.

California Academy of Sciences, Proceedings of the—4th Series, No. V to XVIII, April 22 to June 11, 1927.

Engineers Society of Western Pennsylvania, Proceedings of:

Vol. 43, No. 1, Feb., 1927.
Vol. 42, Feb. 26–Jan. 27.

Field Museum of Natural History: Publication 243, Vol. 7, No. 1, Annual Report of the Director of the Board of Trustees for the Year 1922.

Institution of Mining and Metallurgy: Bulletin 272, May, 1927.

Mining and Metallurgical Society of America: Bulletin 189.

Western Society of Engineers; Journal of the:

Vol. XXXII, No. 4, April, May, 1927.
Vol. XXXII, No. 5, June, 1927.

California, University of: An Eocene Invertebrate Fauna from the La Jolla Quadrangle, California. By Marcus A. Hanna.

Harvard University—Department of Mineralogy and Petrography:

Contributions to Mineralogy, No. 9—A Peculiar Manganiferous Serpentine from Franklin Furnace. By Earl V. Shannon and Esper S. Larsen.
Contributions to Mineralogy, No. 10—The Determination of Plagioclase Feldspars. By Roy W. Goranson.
Contributions to Mineralogy, No. 11—Meteorites in the Mineralogical Museum of Harvard University. By C. Palache.
Contributions to Mineralogy, No. 12—Catalogue of the Collection of Meteorites in the Mineralogical Museum of Harvard University. By Charles Palache.
Contributions to Mineralogy, No. 13—Barysilite from Franklin Furnace, New Jersey. By E. V. Shannon and H. Berman.

Contributions to Mineralogy, No. 14—Uranium Minerals from Lusk, Wyoming. By E. S. Larsen, F. L. Hess and W. T. Schaller.

Contributions to Mineralogy, No. 15—Hyalophane from Franklin Furnace, New Jersey. By L. H. Bauer and C. Palache.

Contributions to Mineralogy, No. 16—A Note on Gyanotrichite. By Charles Palache and H. E. Vassar.

Contributions to Mineralogy, No. 17—Cancrinite as a High Temperature Hydrothermal Mineral from Colorado. By Esper S. Larsen and William F. Foshag.

Contributions to Mineralogy, No. 18—The Tulia Meteorite, Swisher County, Texas. By Charles Palache and John T. Lonsdale.

Contributions to Mineralogy, No. 19—Lollingite from Franklin, New Jersey. By L. H. Bauer and H. Berman.

Contributions to Mineralogy, No. 20—Aegirite from Libby, Montana. By Roy W. Goranson.

Contributions to Mineralogy, No. 21—Memorial of Frederick Alexander Canfield. By Charles Palache.

Contributions to Mineralogy, No. 22—The Occurrence and Properties of Chlorophoenicite. A New Arsenate from Franklin, New Jersey. By William F. Foshag, Harry M. Berman and Robert B. Gage.

The Identity of Gilpinite and Johannite. Reprinted from the American Mineralogist, Vol 11, No. 1, January, 1926. By Esper S. Larsen and Harry Berman.

Japan: Tohoku Imperial University, Sendai: Science Report. Second Series (Geology).

Waseda University: Memoirs of the Faculty of Science and Engineering, No. 4, 1927.

University Te Leiden, Leidsche Geologische Mededeelingen.

McGill University, Montreal: Announcement of the Faculty of Applied Science for the Session of 1927-1928.

Minnesota, University of, School of Mines Experiment Station:

Mining Directory of Minnesota, 1927. By John J. Craig.

Bulletin 12—Minnesota Manganiferous Iron Ore in Relation to the Iron and Steel Industry. By T. L. Joseph and S. P. Kinney.

Sweden: The University of Upsala: Index to Bulletins of the Geological Institution of.

Australia: Chamber of Mines of Western Australia, Kalgoorlie:

President's Address and Election of Officers, Annual Meeting, March 29, 1927.

Also Report of the Executive Council and Production Statistics for 1926.

Western Australia Geological Survey Bulletin No. 91- The Auriferous Lodes of the Gibraltar District, Coolgardie Goldfield. By F. R. Feldtmann.

Bulletin No. 88—Paleontological Contribution to the Geology of Western Australia, Series VII, Nos. XIII, XIV and XV. By Rex W. Bretnall, F. Chapman and Ludwig Glauert.

Annual Progress Report of the Geological Survey of the Year 1925.

Mining Review for Last Half of Year 1926, No. 45. Department of Mines, South Australia.

Barcelona: Real Academia de Ciencias y Artes:

Vol. XIX, Num. 15—La Determinacion Grafica del Desarrollo Intrazonal. By Dr. D. Francisco Pardillo.

Vol. XIX, Num. 16—Apuntes Sobre el Colegio: Cofradia de San Eloy de los Plateros de Barcelona, su Fin, y Evolucion del Oficio en esta Ciudad Hasta Nuestros Dias.

Vol. XIX, Num. 17—Nota Comparativa Sobre el Calculo de las Grandes Cerchas Metalicas Estaticamente Determinadas e Interminadas.

Vol. XX, Num. 1—De La Clasificacion en Malacologia.

Memorias, Tomo XIX.

Canada Department of Mines, Mines Branch: Abrasives, Products of Canada, Part II, Corundum and Diamonds. By V. L. Eardley-Wilmot.

Part III, by V. L. Eardley-Wilmot.

Canadian Mining and Metallurgical Bulletin No. 181.

Bulletin No. 183, July, 1927.

Canadian Pacific Railway, Development Branch:

Arsenic.
Asbestos.
Barytes.
Bituminous Sands of Athabasca.
Chromite.
Clay, Part I, Eastern Canada.
Clay, Part II, Western Canada.
Clay, Part III, Fire and Ball.
Clay, Part IV, Kaolin or China Clay.
Coal, Part I, Eastern Canada.
Coal, Part II, Western Canada.
Cobalt.
Copper.
Diatomaceous Earth (Tripolite).
Feldspar.
Fluorspar.
Forests, Part I, Eastern Canada.
Forests, Part II, Western Canada.
Granite.
Graphite.
Gypsum.
Iron.
Lead and Zinc.
Limestone.
Lithium Minerals in Manitoba.
Magnesite.
Manganese.
Mica.
Mineral Water.
Mining Situation in Canada.
Molybdenum.
Natural Gas.
Nickel.
Ochre (Iron Oxide).
Peat.
Petroleum, Part I, Eastern Canada.
Platinum and Related Metals.
Pyrites.
Salt.
Sand and Gravel.
Silver.
Slate.
Sulphates of Sodium and Magnesium.
Talc and Steatite.

Lima (Peru): Ministerio de Fomento; Carbon y Fierro No. 1, Decretos.

Mexico:

Revista Mensual de los Actividades Petroleros En Mexico. Secretaria de Industria, Comercio y Trabajo. Departamento de Petroleo, Febrero, Abril y Mayo, 1927.
Bibliografia del Petroleo En Mexico, 1925.
Indica Correspondiente al Volumen XXII, Del Boletin Del Petroleo, Julio a Diciembre de 1926.
Boletin del Petroleo, Febrero de 1927.
Boletin Minero, Junio de 1927.
Su Aspecta Legal y su Reglamentacion por Jose Coloma y El Estado Actual de Esa Industrio por Gustavo Orgeto, 1927.

Estradistica Nacional Revista, Quincenal, Marzo 30, Abril 15, Abril 30, Mayo 15.
Estradistica Nacional Revista, Quincenal, 1927.
Organo del Departamento de Minas, Boletin Minero, Tomo XXIII, Numero 4.

New Zealand Geological Survey:

Bulletin No. 29—The Geology of the Egmont Subdivision, Taranaki. By T. J. Morgan and W. Gibson.
Paleontological Bulletin 12—Contributions to the Paleontology of the New Zealand Trios.

Ontario Department of Mines: 35th Annual Report, Parts I, V and VI.

Peru: Boletin del Cuerpo de Ingenieros de Minas del Peru, 108:
Informe Sobre los Humos de la Oroya, 1926.

Philippine Journal of Science:

Vol. XXXII, No. 4, April, 1927.
Vol. XXXII, No. 1, May, 1927.

Poland:

Statistics on the Mining and Metallurgical Industries for the Month of January, 1927. Ministerstwo Przemyslu I Handlu Departament Gorniczo-Hutniczy.
Leidsche Geologische Mededeelingen Deel II, Aflevering 2. By Dr. B. G. Escher. Partly written in English.

De la Societe Polonaise des Naturalistes Kopernik, Vol. LI. Geologia, Mineralogja I Petrografja.
Rio de Janeiro: Boletin de Museu Nacional, Vol. II. No. 4, 1926.
South Africa: President French's Address to the Transvaal Chamber of Mines, Mar. 28, 1927. Reprint from Mineralogical Magazine Dec., 1921, No. 95: On Carnotite from Bwona Mkubwa, Northern Rhodesia.

U. S. S. Republic:

Scientific-Technical Department of the Supreme Council of National Economy. No. 167—On the Uniformity of the Determination of Mechanical Properties of Sedimentary Rocks. By J. W. Samojloff.

On New Methods of the Mechanical Analysis and on Classification of Fractions. By W. A. Silberminz and M. W. Klenowa.

No. 77—The Natural Iron Dyes. By I. Koubatoff.

No. 168—On Limestones of the Donetz Basin Containing Sulfuretted Hydrogen. By W. A. Silberminz and K. F. Terentieva.

No. 138—Research Work of the X-Ray Department.

No. 184—Petrographical Description of the Valley of Soimonovsk. The Mountain Karabash. By E. A. Kouznetsov.

No. 139—Contributions to the Lythological Character of Sedimentary Rocks. By J. V. Samojloff and L. V. Pustovaloff.

Economic Geology, Vol. XXII. No. 4, June and July, 1927.

Bituminous Sands of Alberta. By K. A. Clark.

Geology of the Cave-in Rock Quadrangle. By Stuart Weller.

Flora of the Chicago Region. By H. S. Bepoon.

Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

American Petroleum Institute, New York.
Architect and Engineer, San Francisco.
Arizona Mining Journal, Phoenix, Arizona.
Asbestos, Philadelphia, Pennsylvania.
Brick and Clay Record, Chicago.
Bulletin, Union Oil Co., Los Angeles.
California Journal of Development, San Francisco.
Cement, Mill and Quarry, Chicago, Illinois.
Chemical-Engineering and Mining Review, Melbourne, Australia.
Engineering and Mining Journal, New York.
Explosives Engineer, Wilmington, Del.
Financial Insurance News, Los Angeles, California.
Graphite, Jersey City.
Journal of Electricity and Western Industry, San Francisco.
Metallurgical and Chemical Engineering, New York.
Mine and Quarry, Chicago.
Mining and Engineering Record, Vancouver, B. C.
Mining and Oil Bulletin, Los Angeles.
Oil Age, Los Angeles.
Oil and Gas Journal, Tulsa, Oklahoma.
Oil and Gas News, Kansas City.
Oil News, Galesburg, Illinois.
Oildom, New York.
Oil, Paint and Drug Reporter, New York.
Oil Trade Journal, New York.
Oil Weekly, Houston, Texas.
Petroleum Age, New York.
Petroleum Record, Los Angeles.
Petroleum World, Los Angeles.
Queensland Government Mining Journal, Brisbane, Australia.
Rock Products, Chicago, Illinois.
Safety News, Industrial Accident Commission, San Francisco.
Salt Lake Mining Review, Salt Lake City, Utah.
Southwest Builder and Contractor, Los Angeles
Standard Oil Bulletin, San Francisco.
Stone, New York.
The Record, Associated Oil Company, San Francisco.
Through the Ages, Baltimore.

Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.
Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).
Barstow Printer, Barstow, Cal.
Blythe Herald, Blythe, Cal.
Bridgeport Chronicle-Union, Bridgeport, Mono Co., Cal
Calaveras Prospect, San Andreas, Cal.
California Oil World, Los Angeles, Cal.
Cloverdale Reveille, Cloverdale, Cal.
Colusa Daily Sun, Colusa, Cal.
Daily Commercial News, San Francisco, Cal.
Daily Midway Driller, Taft, Cal.
Del Norte Triplicate, Crescent City, Cal.
Exeter Sun, Exeter, Cal.
Gateway Gazette, Beaumont, Cal.
Goldfield News, Goldfield, Nevada.
Guerneville Times, Guerneville, Cal.
Healdsburg Enterprise, Healdsburg, Cal.
Humboldt Standard, Eureka, Cal.
Inyo Independent, Independence, Cal.
Inyo Register, Bishop, Cal.
Ione Valley Echo, Ione, Cal.
Lake County Bee, Lakeport, Cal.
Mining and Financial Record, Denver, Colo.
Mining Topics, San Francisco, Cal.
Mountain Democrat, Placerville, Cal.
Mountain Messenger, Downieville, Cal.
Nevada Mining Press, Reno, Nevada.
Oatman Mining News, Oatman, Arizona.
Oregon Observer, Grants Pass, Oregon.
Oroville Daily Register, Oroville, Cal.
Petroleum Reporter, Taft, Cal.
Placer Herald, Auburn, Cal.
Plumas Independent, Quincy, Cal.
Plumas National Bulletin, Quincy, Cal.
Randsburg Times, Randsburg, Cal.
San Diego News, San Diego, Cal.
Shasta Courier, Redding, Cal.
Siskiyou News, Yreka, Cal.
Stockton Record, Stockton, Cal.
Tuolumne Prospector, Tuolumne, Cal.
Ventura Daily Post, Ventura, Cal.
Weekly Trinity Journal, Weaverville, Cal.
Western Sentinel, Etna Mills, Cal.



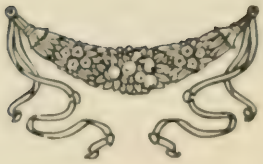
PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

When the publication of MINING IN CALIFORNIA was on a monthly basis, current inquiries from buyers and sellers were summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to the present quarterly publication of MINING IN CALIFORNIA, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes,' and sent to those on the mailing list for MINING IN CALIFORNIA.



EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate attention.

The Bureau registers technical men, or those qualified for supervisory positions, and vacancies of like nature, only, as no attempt will be made to supply common mine and mill labor.

A list of current applications for positions and 'positions open' is carried in each issue. Notices are designated by a key number, and the name and address corresponding to any number will be supplied upon request, without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Bureau, to avoid possible loss. Registration cards for the use of both prospective employers and employees may be obtained at any office of the Bureau upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

POSITIONS WANTED.

51– 6 Superintendent. Five years' varied experience in California and Arizona. Age 33. Single. References. Salary, open.

51– 7 Superintendent. Thirteen years' experience in West. Age 47. Married. References. Salary wanted, $250 minimum.

51– 8 Superintendent of Mine or Mill. Twenty-two years in Mexico and California in charge of gold and silver mines. Can design modern mills. Will accept half salary in stock of good property in California or Arizona. Age 44. Salary wanted, $200 to $500.

51– 9 Mill Superintendent or Foreman. Ten years' experience Mexico and Arizona. Age 38. Married. Salary, open.

51–10 Practical Hydraulic Miner.

51–11 Employment Manager, Time-keeper, Store-keeper, etc. Eight years' experience with Jackling interests. Age 34. Single. References. Salary, open.

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PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

During the past forty-four years, in carrying out the provisions of the organic act creating the California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the Bureau's offices in the Ferry Building, San Francisco; New Orpheum Building, Los Angeles; Chamber of Commerce Building, Sacramento; Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications of the Bureau, from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the offices of the State Mining Bureau and enclosing the requisite amount in the case of publications that have a list price. The Bureau is authorized to receive only coin, stamps or money orders, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the State Mining Bureau.

REPORTS.

Asterisks (**) indicate the publication is out of print.

	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks	----
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks	----
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks	----
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks	----
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks	----
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. Henry G. Hanks	----
**Part II, 1887, 222 pp., 36 illustrations. William Irelan, Jr.	----
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Irelan, Jr.	----
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustrations. William Irelan, Jr.	----
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Irelan, Jr.	----
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Irelan, Jr.	----

REPORTS—Continued.

Asterisks (**) indicate the publication is out of print.

Price

Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892. 612 pp., 73 illustrations, 4 maps. William Irelan, Jr. $1.00

**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps. J. J. Crawford .....

**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford .....

Chapters of the State Mineralogist's Report, Biennial Period, 1913-1914. Fletcher Hamilton:

**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper .....

Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper ..... .50

Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper ..... .25

**Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pages, paper .....

Mines and Mineral Resources of Imperial and San Diego Counties, 113 pp., paper ..... .35

**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper .....

**Fourteenth Report of the State Mineralogist, for the Biennial Period 1913-1914. Fletcher Hamilton, 1915:

A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth .....

Chapters of the State Mineralogist's Report, Biennial Period, 1915-1916. Fletcher Hamilton:

**Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp., paper .....

**Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama Counties, 91 pp., paper .....

Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper ..... .65

Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper ..... .65

Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties, 136 pp., paper ..... .50

**Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp., paper .....

**Fifteenth Report of the State Mineralogist, for the Biennial Period 1915-1916. Fletcher Hamilton, 1917

A General Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp., 413 illustrations, cloth .....

Chapters of the State Mineralogist's Report, Biennial Period 1917-1918. Fletcher Hamilton:

Mines and Mineral Resources of Nevada County, 270 pp., paper ..... .75

Mines and Mineral Resources of Plumas County, 188 pp., paper ..... .50

Mines and Mineral Resources of Sierra County, 144 pp., paper ..... .50

Seventeenth Report of the State Mineralogist, 1920. Mining in California during 1920. Fletcher Hamilton: 562 pp., 71 illustrations, cloth 1.75

REPORTS—Continued.

Asterisks (**) indicate the publication is out of print. Price

Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with January, 1922:

**January, **February, March, April, May, June, July, August, September, October, November, December, 1922 ---------- Free

Chapters of Nineteenth Report of the State Mineralogist, 'Mining in California,' Fletcher Hamilton and Lloyd L. Root. January, February, March, September, 1923 ---------- Free

Chapters of Twentieth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly. January, April, July, October, 1924, per copy ---------- $0.25

Chapters of Twenty-first Report of the State Mineralogist, 'Mining in California.' Lloyd L. Root. Published quarterly.

January, 1925, Mines and Mineral Resources of Sacramento, Monterey and Orange counties ---------- .25

April, 1925, Mines and Mineral Resources of Calaveras, Merced, San Joaquin, Stanislaus and Ventura counties ---------- .25

July, 1925, Mines and Mineral Resources of Del Norte, Humboldt and San Diego counties ---------- .25

October, 1925, Mines and Mineral Resources of Siskiyou, San Luis Obispo and Santa Barbara counties ---------- .25

Subscription, $1.00 in advance (by calendar year, only).

Chapters of Twenty-second Report of the State Mineralogist, 'Mining in California.' Lloyd L. Root. Published quarterly.

January, 1926, Mines and Mineral Resources of Trinity and Santa Cruz counties ---------- .25

April, 1926, Mines and Mineral Resources of Shasta, San Benito and Imperial counties ---------- .25

July, 1926, Mines and Mineral Resources of Marin and Sonoma Counties ---------- .25

October, 1926, Mines and Mineral Resources of El Dorado and Inyo counties, also report on Minaret District, Madera County ---------- .25

Chapters of Twenty-third Report of the State Mineralogist, 'Mining in California.' Lloyd L. Root. Published quarterly.

January, 1927, Mines and Mineral Resources of Contra Costa County; Santa Catalina Island ---------- .25

April, 1927, Mines and Mineral Resources of Amador and Solano counties ---------- .25

July, 1927, Mines and Mineral Resources of Placer and Los Angeles counties .25

Chapters of State Oil and Gas Supervisor's Report:

Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume) ---------- Free

Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:

**April, **May, June, **July, **August, **September, **October, November, **December, 1919 ---------- Free

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January, February, March, April, May, June, July, August, September, October, November, December, 1926 ---------- Free

January, 1927 ---------- Free

BULLETINS.

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**Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations ----

**Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps ----

**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.) ---

**Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations ----

Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston. 85 pp., 46 illustrations $0.50

**Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 9. Mine Drainage, Pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations ----

**Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp. ----

**Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps, 31 illustrations ----

**Bulletin No. 12. Mineral Production of California, by Counties for 1896, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 13. Mineral Production of California, by Counties for 1897, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 14. Mineral Production of California, by Counties for 1898, by Charles G. Yale ----

**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H. Means. 1899 ----

**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations ----

**Bulletin No. 17. Mineral Production of California, by Counties for 1899, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations ----

**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps ----

**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years ending December, 1899 ----

**Bulletin No. 21. Mineral Production of California by Counties, by Charles G. Yale. 1900. Tabulated sheet ----

**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet ----

Bulletin No. 23. The Copper Resources of California, by P. C. DuBois, F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69 illustrations, and 9 maps .50

**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps ----

**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 26. Mineral Production of California for the past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet ----

**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps ----

**Bulletin No. 28. Mineral Production of California, for 1902, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet ----

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**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology, and Mineral Resources of California, by A. W. Vogdes. 1903, 290 pp. ----

**Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N. Cooper. 1904. Tabulated sheet ----

**Bulletin No. 32. Production and Use of Petroleum in California, by Paul W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps ----

**Bulletin No. 33. Mineral Production of California, by Counties, for 1903, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 34. Mineral Production of California for Seventeen Years, by Charles G. Yale. 1904. Tabulated sheet ----

**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale. 1904, 55 pp., 20 county maps. Relief map of California ----

**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905, 120 pp., 66 illustrations, 3 maps ----

**Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of California, by George F. Kunz. 1905. 168 pp., 54 illustrations ----

**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906, 412 pp., 150 illustrations, 1 map ----

**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet ----

**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles G. Yale. 1905, 54 pp., 20 county maps ----

**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 43. Mineral Production of California for Nineteen Years, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G. Yale. 1907, 31 pp., 20 county maps ----

**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907. 10 pp. ----

Bulletin No. 46. General Index of Publications of the California State Mining Bureau, by Charles G. Yale. 1907, 54 pp. $0.30

**Bulletin No. 47. Mineral Production of California, by Counties, 1906, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 48. Mineral Production of California for Twenty Years, 1906, by Charles G. Yale ----

**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles G. Yale. 34 pp. ----

Bulletin No. 50. The Copper Resources of California, 1908, by A. Haus-mann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp., 74 illustrations. (Revised edition.) 1.00

**Bulletin No. 51. Mineral Production of California, by Counties, 1907, by D. H. Walker. Tabulated sheet ----

**Bulletin No. 52. Mineral Production of California for Twenty-one Years, 1907, by D. H. Walker. Tabulated sheet ----

**Bulletin No. 53. Mineral Production of California for 1907, with County Maps, by D. H. Walker, 62 pp. ----

**Bulletin No. 54. Mineral Production of California, by Counties, by D. H. Walker, 1908. Tabulated sheet ----

**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet ----

**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by D. H. Walker. 78 pp. ----

**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps ----

**Bulletin No. 58. Mineral Production of California, by Counties, by D. H. Walker, 1909. Tabulated sheet ----

**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker, 1909. Tabulated sheet ----

**Bulletin No. 60. Mineral Production for 1909, County Maps and Mining Laws of California, by D. H. Walker. 94 pp. ----

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**Bulletin No. 62. Mineral Production of California for Twenty-four Years, by D. H. Walker, 1910. Tabulated sheet ----

**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman. 1912, 430 pp., 41 illustrations, 6 maps ----

**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp. ----

**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp. ----

**Bulletin No. 66. Mining Laws of the United States and California. 1914, 89 pp. ----

**Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914, 226 pp. ----

**Bulletin No. 68. Mineral Production for 1913, with County Maps and Mining Laws, by E. S. Boalich. 160 pp. ----

**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps (18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.] ----

**Bulletin No. 70. Mineral Production for 1914, with County Maps and Mining Laws. 184 pp. ----

**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations ----

Bulletin No. 72. The Geologic Formations of California, by James Perrin Smith. 1916. 47 pp. $0.25

**Reconnaissance Geologic Map (of which Bulletin 72 is explanatory), in 23 colors. Scale: 1 inch = 12 miles. Mounted ----

**Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the fiscal year 1915–16, by R. P. McLaughlin. 278 pp., 26 illustrations ----

Bulletin No. 74. Mineral Production of California in 1916, with County Maps, by Walter W. Bradley. 179 pp., 12 illustrations Free

**Bulletin No. 75. United States and California Mining Laws, 1917. 115 pp., paper ----

Bulletin No. 76. Manganese and Chromium in California, by Walter W. Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A. Waring, 1918. 248 pp., 51 illustrations, 5 maps, paper .50

Bulletin No. 77. Catalogue of Publications of California State Mining Bureau, 1880–1917, by E. S. Boalich. 44 pp., paper Free

Bulletin No. 78. Quicksilver Resources of California, with a Section on Metallurgy and Ore-Dressing, by Walter W. Bradley, 1918. 389 pp., 77 photographs and 42 plates (colored and line cuts), cloth 1.50

Bulletin No. 79. Magnesite in California, by Walter W. Bradley, 1925, 147 pp., 62 photographs, 11 line cuts and maps, cloth 1.00

Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California. (In preparation.) ----

Bulletin No. 81. Foothill Copper Belt of California. (In preparation.) ----

**Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1916–1917, by R. P. McLaughlin, 1918. 412 pp., 31 illustrations, cloth ----

Bulletin No. 83. California Mineral Production for 1917, with County Maps, by Walter W. Bradley. 179 pp., paper Free

**Bulletin No. 84. Third Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1917–1918, by R. P. McLaughlin, 1918. 617 pp., 28 illustrations, cloth ----

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**Bulletin No. 87. Commercial Minerals of California, with notes on their uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello, 1920. 124 pp., paper ----

Bulletin No. 88. California Mineral Production for 1919, with County Maps, by Walter W. Bradley, 1920. 204 pp., paper Free

**Bulletin No. 89. Petroleum Resources of California, with Special Reference to Unproved Areas, by Lawrence Vander Leck, 1921. 12 figures, 6 photographs, 6 maps in pocket, 186 pp., cloth ----

BULLETINS—Continued.

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Bulletin No. 92. Gold Placers of California, by Chas. S. Haley, 1923. 167 pp., 36 photographs and 7 plates (colored and line cuts, also geologic map), cloth---------- 1.50

Extra copies of the Geologic Map (in 4 colors)---------- .50

Bulletin No. 93. California Mineral Production for 1922, by Walter W. Bradley, 1923, 188 pp., paper---------- Free

Bulletin No. 94. California Mineral Production for 1923, by Walter W. Bradley, 1924, 162 pp., paper---------- Free

Bulletin No. 95. Geology and Ore Deposits of the Randsburg Quadrangle, by Carlton D. Hulin, 1925. 152 pp., 49 photographs, 13 line cuts, 1 colored geologic map, cloth---------- 2.00

Bulletin No. 96. California Mineral Production for 1924, by Walter W. Bradley, 1925. 173 pp., paper---------- Free

Bulletin No. 97. California Mineral Production for 1925, by Walter W. Bradley, 1926. 172 pp., paper---------- Free

PRELIMINARY REPORTS.

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**Preliminary Report No. 1. Notes on Damage by Water in California Oil Fields, December, 1913. By R. P. McLaughlin. 4 pp.---------- ----

**Preliminary Report No. 2. Notes on Damage by Water in California Oil Fields, March, 1914. By R. P. McLaughlin. 4 pp.---------- ----

Preliminary Report No. 3. Manganese and Chromium, 1917. By E. S. Boalich. 32 pp.---------- Free

Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper---------- Free

Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper-- Free

**Preliminary Report No. 6. A Review of Mining in California During 1919. Fletcher Hamilton, 1920. 43 pp. Paper---------- ----

**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker, 1920. 102 pp. 24 illustrations. Paper---------- ----

**Preliminary Report No. 8. A Review of Mining in California During 1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922. 68 pp. Paper---------- ----

MISCELLANEOUS PUBLICATIONS.

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**First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 1881. 350 pp.---------- ----

**Catalogue of books, maps, lithographs, photographs, etc., in the library of the State Mining Bureau at San Francisco, May 15, 1884. 19 pp.---- ----

**Catalogue of the State Museum of California, Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220 pp.---------- ----

**Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31, 1887. 195 pp.---------- ----

**Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August 20, 1890. 261 pp.---------- ----

**Catalogue of the Library of the California State Mining Bureau, September 1, 1892. 149 pp.---------- ----

**Catalogue of West North American and Many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894---------- ----

**Report of the Board of Trustees for the four years ending September, 1900. 15 pp. Paper---------- ----

MISCELLANEOUS PUBLICATIONS—Continued.

Asterisks (**) indicate the publication is out of print. Price

Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper ---- Free

Commercial Mineral Notes. A monthly mimeographed sheet, beginning April, 1923 ---- Free

MAPS.

Register of Mines With Maps.

Asterisks (**) indicate out of print.

**Register of Mines, with Map, Amador County ----
**Register of Mines, with Map, Butte County ----
**Register of Mines, with Map, Calaveras County ----
**Register of Mines, with Map, El Dorado County ----
**Register of Mines, with Map, Inyo County ----
**Register of Mines, with Map, Kern County ----
**Register of Mines, with Map, Lake County ----
**Register of Mines, with Map, Mariposa County ----
**Register of Mines, with Map, Nevada County ----
**Register of Mines, with Map, Placer County ----
**Register of Mines, with Map, Plumas County ----
**Register of Mines, with Map, San Bernardino County ----
**Register of Mines, with Map, San Diego County ----
Register of Mines, with Map, Santa Barbara County (1906) $0.25
**Register of Mines, with Map, Shasta County ----
**Register of Mines, with Map, Sierra County ----
**Register of Mines, with Map, Siskiyou County ----
**Register of Mines, with Map, Trinity County ----
**Register of Mines, with Map, Tuolumne County ----
Register of Mines, with Map, Yuba County (1905) .25
Register of Oil Wells, with Map, Los Angeles City (1906) .35

OTHER MAPS.

Asterisks (**) indicate the publication is out of print.

**Map of California, Showing Mineral Deposits (50 x 60 in.) ----
**Map of Forest Reserves in California ----
**Mineral and Relief Map of California ----
**Map of El Dorado County, Showing Boundaries, National Forests ----
**Map of Madera County, Showing Boundaries, National Forests ----
**Map of Placer County, Showing Boundaries, National Forests ----
**Map of Shasta County, Showing Boundaries, National Forests ----
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**Map of Mother Lode Region ----
**Map of Desert Region of Southern California ----
Map of Minaret District, Madera County .20
Map of Copper Deposits in California .05
**Map of Calaveras County ----
**Map of Plumas County ----
**Map of Trinity County ----
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Geological Map of Inyo County. Scale 1 inch equals 4 miles .60
Map of California accompanying Bulletin No. 89, showing generalized classification of land with regard to oil possibilities. Map only, without Bulletin .25
**Geological Map of California, 1916. Scale 1 inch equals 12 miles. As accurate and up-to-date as available data will permit as regards topography and geography. Shows railroads, highways, post offices and other towns. First geological map that has been available since 1892, and shows geology of entire state as no other map does. Geological details lithographed in 23 colors. Mounted ----
Topographic Map of Sierra Nevada Gold Belt, showing distribution of auriferous gravels, accompanying Bulletin No. 92 (also sold singly). In 4 colors .50

OIL FIELD MAPS.

These maps are revised from time to time as development work advances and ownerships change.

		Price
Map No. 1	Sargent, Santa Clara County	$0.50
Map No. 2	Santa Maria, including Cat Canyon and Los Alamos	.75
Map No. 3	Santa Maria, including Casmalia and Lompoc	.75
Map No. 4	Whittier-Fullerton, including Olinda, Brea Canyon, Puente Hills, East Coyote and Richfield	.75
Map No. 5	Whittier-Fullerton, including Whittier, West Coyote, and Montebello	.75
Map No. 6	Salt Lake, Los Angeles County	.75
Map No. 7	Sunset and San Emido and Kern County	.75
Map No. 8	South Midway and Buena Vista Hills, Kern County	.75
Map No. 9	North Midway and McKittrick, Kern County	.75
Map No. 10	Belridge and McKittrick, Kern County	.75
Map No. 11	Lost Hills and North Belridge, Kern County	.75
Map No. 12	Devils Den, Kern County	.75
Map No. 13	Kern River, Kern County	.75
Map No. 14	Coalinga, Fresno County	1.00
Map No. 15	Elk Hills, Kern County	.75
Map No. 16	Ventura-Ojai, Ventura County	.75
Map No. 17	Santa Paula-Sespe Oil Fields, Ventura County	.75
Map No. 18	Piru-Simi-Newhall Oil Fields	.75
Map No. 19	Arroyo Grande, San Luis Obispo County	.75
Map No. 20	Long Beach Oil Field	1.25
Map No. 21	Portion of District 4, Showing Boundaries of Oil Fields, Kern and Kings counties	.75
Map No. 22	Portion of District 3, Showing Oil Fields, Santa Barbara County	.75
Map No. 23	Portion of District 2, Showing Boundaries of Oil Fields, Ventura County	.75
Map No. 24	Portion of District 1, Showing Boundaries of Oil Fields, Los Angeles and Orange counties	.75
Map No. 26	Huntington Beach Oil Field	.75
Map No. 27	Santa Fe Springs Oil Field	.75
Map No. 28	Torrance, Los Angeles County	.75
Map No. 29	Dominguez, Los Angeles County	.75
Map No. 30	Rosecrans, Los Angeles County	.75
Map No. 31	Inglewood, Los Angeles County	.75
Map No. 32	Seal Beach, Los Angeles and Orange Counties	.75

DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the state may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

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THE STATE MINING BUREAU

CORDIALLY INVITES YOU TO VISIT
ITS VARIOUS DEPARTMENTS MAINTAINED
FOR THE PURPOSE OF FURTHERING
THE DEVELOPMENT OF THE

MINERAL RESOURCES OF CALIFORNIA

At the service of the public are the scientific reference library and reading room, the general information bureau, the laboratory for the free determination of mineral samples found in the state, and the largest museum of mineral specimens on the Pacific Coast. The time and attention of the State Mineralogist, as well as that of his technical staff, are also at your disposal.

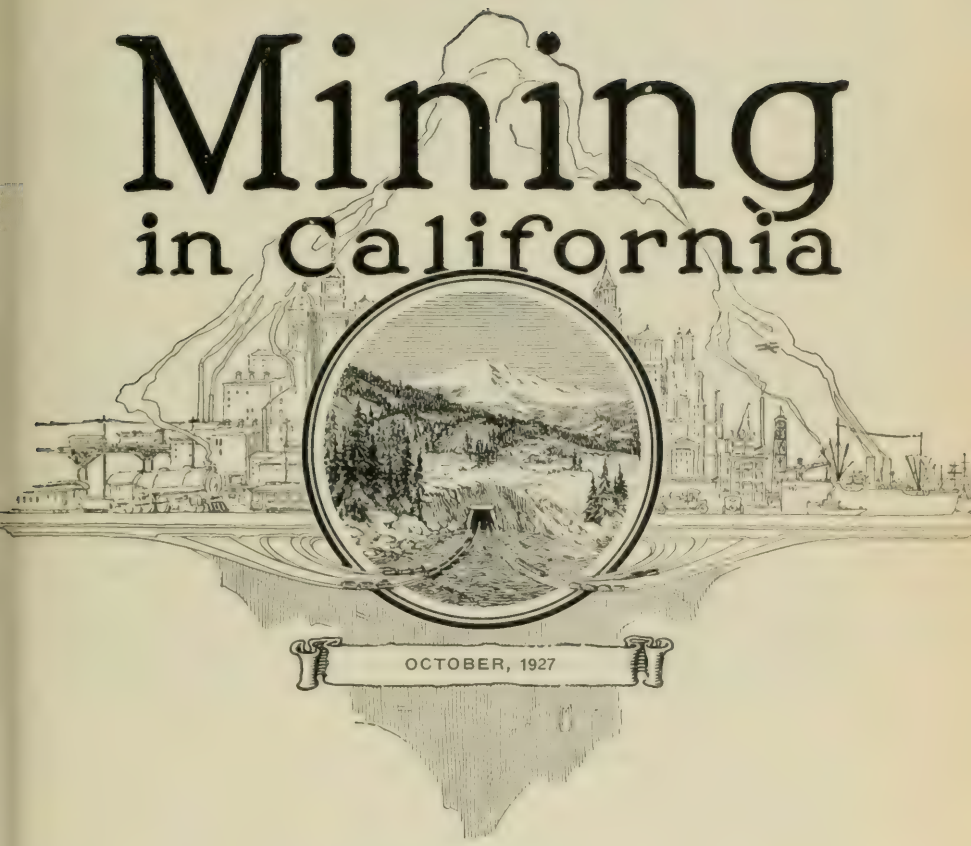
Office hours: 9 a.m. to 5 p.m. daily.
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Mining in California



OCTOBER, 1927

PUBLISHED QUARTERLY

STATE OF CALIFORNIA
DIVISION OF MINES AND MINING

FERRY BUILDING
SAN FRANCISCO

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DEPARTMENT OF PETROLEUM AND GAS

R. D. Bush, State Oil and Gas Supervisor - - - - - - San Francisco

Note.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the State Mining Bureau, entitled 'Summary of Operations, California Oil Fields.'

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND MINING
FERRY BUILDING, SAN FRANCISCO

LLOYD L. ROOT — State Mineralogist

Vol. 23 — OCTOBER, 1927 — No. 4

CHAPTER OF

REPORT XXIII OF THE STATE MINERALOGIST

COVERING

MINING IN CALIFORNIA

AND THE

ACTIVITIES OF THE DIVISION OF MINES AND MINING



CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1927

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DIVISION OF MINES AND MINING
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PREFACE.

The Division of Mines and Mining (formerly State Mining Bureau) is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing this was changed to quarterly publication, beginning in September, 1923.

For the same reason, beginning with the January, 1924, issue, it has been necessary to charge a subscription price of $1 per calendar year, payable in advance; single copies, 25 cents apiece. 'Mining in California' will continue to be sent without charge to our exchange list, including schools and public libraries, as are also other publications of the Division of Mines and Mining.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the practice of issuing from time to time technical reports on special subjects will be continued, as well. A list of such reports now available is appended hereto, and the names of new bulletins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Division of Mines and Mining is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.

DISTRICT REPORTS OF MINING ENGINEERS.

In 1919–1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district, working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively. This move brought the office into closer personal contact with operators, and it has many advantages over former methods of conducting field work. In 1923 the Redding and Auburn field offices were consolidated and moved to Sacramento.

The boundaries of each district were adjusted and the counties now included in each of the three divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

New County Reports.

The series of separate reports on the mines and mineral resources of the different counties, that together comprise the State Mineralogist's Reports XIV to XVII, inclusive, in the case of many of the counties have become exhausted. Those still in stock are in need of revision. It was deemed advisable, therefore, beginning with the January, 1925, issue of 'Mining in California,' to make the district engineers' reports in the form of a complete general report on the mines and mineral resources in one or more of the counties in each district.

This program will be followed as near as possible in succeeding numbers of the quarterly until each county in the state has been covered.

SACRAMENTO FIELD DIVISION.

C. A. Logan, Mining Engineer.

On account of unfinished field work there is no report from the Sacramento Field Division in this issue.

SAN FRANCISCO FIELD DIVISION.

C. McK. Lalzure, Mining Engineer.

On account of unfinished field work there is no report from the San Francisco Field Division in this issue.

LOS ANGELES FIELD DIVISION.

W. Burling Tucker, Mining Engineer.

MONO COUNTY.

Mono County was created April 24, 1861, and consists of 3030 square miles. It is bounded on the north and east by the state of Nevada, on the south by Inyo County and on the west by Madera, Tuolumne and Alpine counties. The county is extremely mountainous, the western portion lying among the Sierra Nevada Mountains, whose principal peaks rise to elevations of over 13,000 feet. The greater portion of the county, in its larger features, is a broad table land at an altitude of from 5000 to 7000 feet above sea level, traversed by a series of approximately parallel ranges running northerly and southerly, which rise several thousand feet above the plateau. The other prominent mountain ranges are the Sweetwater Mountains, along the eastern border of the county in its northern portion, and the White Mountains crossing its extreme southeast corner.

Mono Lake is the only large body of water in the county. It lies ten miles south of Bodie at an elevation of 6426 feet above sea level, with an approximate area of 1100 square miles. The water of this lake contains carbonate and sulphate of soda, sodium chloride, borax and other salts. A detailed description of this lake, by I. C. Russell, is contained in U. S. Geol. Survey Monograph XI, p. 267, 1885. The principal streams are Owens River, in the south, which rises in a high peak of the Sierras and flows southward, formerly emptying into Owens Lake, but at present whose waters are conveyed by an aqueduct as a supply for the city of Los Angeles; and the Walker River, which flows northward into Nevada. Mining and stock raising are the principal industries in the county.

The period of greatest activity in mining was from 1876 until 1888. The most productive gold districts have been Bodie, Masonic and Mono Lake. The principal production of silver has come from the Blind Springs Hill District, near Benton. The lack of railroad transportation has retarded the development of the highly mineralized belt that runs through the county. The only railroad in the county is the Nevada-California Railroad, which runs through the southeast corner of the county for a distance of 68 miles. In recent years the increase in travel during the summer months of the general public to the large number of pleasure resorts located in the high Sierra has led to the improvement of the main travel routes throughout the county.

General Geology.

The west boundary of the county, extending in a northwest direction from San Joaquin Peak to Topaz, is made up with deep-seated granitic rocks, including granites, diorites, granodiorites and gabbros, also metamorphic gneisses and schists. Included in this mass of granitic rocks, there is a belt of Cambrian limestones that extends from June Lake in a northerly direction to Virginia Creek. The central part of this belt of limestone is located west of Mono Lake, being about three miles in width on its southerly extremity, while at its northern limits it is about six miles wide. In the Mono Lake and Lundy districts, the belt is made up of metamorphic limestones, slates, greenstones and quartzites.

MONO COUNTY MINERAL PRODUCTION, 1880-1926.

Year	Gold, value	Silver, value	Lead		Lime		Miscellaneous and unapportioned		
			Pounds	Value	Barrels	Value	Amount	Value	Substance
1880	$2,407,236	$582,905							
1881	3,385,000	300,000							
1882	2,200,000	380,000							
1883	1,750,000	290,000							
1884	1,000,000	285,000							
1885	482,860	91,849							
1886	439,558	163,502							
1887	382,498	118,945							
1888	297,000	75,000							
1889	193,564	86,827							
1890	144,180	52,293							
1891	302,415	18,983							
1892	396,296	271,058							
1893	293,637	11,401							
1894	358,824	11,549	50,000	$1,500					
1895	552,650	84,910	94,400	2,926			800 cu. ft.	$8,000	Onyx.
1896	451,553	82,283	73,500	2,205	500	$2,000	3,000 cu. ft.	24,000	Onyx.
1897	520,101	72,491	32,000	1,088	1,200	4,800			
1898	446,017	66,667	75,000	2,737	3,000	4,000			
1899	697,069	47,547	28,000	1,190	1,200	3,750			
1900	670,200	75,921	50,000	2,000	1,100	4,000			
1901	493,355	25,091	29,000	1,160	2,000	3,000	1,938 lbs.	305	Copper.
1902	510,596	36,548	4,400	154	2,000	2,000			
1903	334,713	20,067	1,000	36	1,818	5,000	1,600 lbs.	208	Copper.
1904	268,930	2,955			215	850			
1905	308,884	11,240							
1906	338,698	13,151							
1907	383,971	29,797							
1908	413,946	26,134					7,100 gals.	5,575	Mineral water.
1909	354,909	37,792						106,772	Unapportioned, 1900-1909.
1910	435,724	9,391							
1911	261,232	35,508	37,000	1,665					
1912	377,518	70,602	23,936	1,077	4,961	3,721	8,179 lbs.	1,350	Copper.
1913	147,271	23,263			2,135	1,600	79,319 lbs.	12,294	Copper.
1914	7,000	10,000					1,000 lbs.	150	Salt.
1915	107,302	1,923						200	Other minerals.
1916	237,084	3,606						300	Other minerals.
1917	209,040	5,662	1,912	164				3,906	Copper, molybdenum salt.
1918	31,252	22,727	1,318	94			160 lbs.	40	Copper
								750	Other minerals.
1919	29,428	55,558	1,556	82			539 lbs.	100	Copper.
							3,215 lbs.	592	Copper.
1920	144,746	34,369	85,014	6,801				1,000	Miscellaneous stone.
								750	Other minerals.
1921	37,754	15,160	42,962	1,933			2,940 lbs.	379	Copper.
								1,650	Onyx and salt.
1922	65,747	11,085	9,820	540			4,338 lbs.	586	Copper
								8,304	Other minerals.
1923	34,661	3,120						10,000	Stone, miscellaneous.
								45,010	Other minerals.
1924	49,651	6,472	32,458	2,597				19,044	Stone, miscellanous.
								48,927	Other minerals.
1925	5,503	1,590	22,488	1,957				20,250	Stone, miscellaneous.
								146,300	Other minerals.
1926	20,204	121,401	20,906	1,672			2,628	368	Copper
								66,200	Other minerals.
Totals	$22,979,517	$3,803,947	716,670	$73,578	20,129	$34,721		$542,310	

The central and major portion of the county is covered by volcanic lavas and tuffs, chiefly andesites, but including some basalts and small amounts of rhyolite.

In this area the major portion of the ridges is made up of granitic rocks which strike northerly and are more or less parallel. Blind Spring Hill, which is located east of Benton, is made up of deep seated granitic rocks. The rock is a coarsely crystalline hornblende granite. This granite range is six miles in length from north to south and three miles in width from east to west. The White Mountain range is located in the southeastern end of the county, being a continuation of the Inyo range of mountains, and extends north from the Inyo County line into the State of Nevada. The White Mountain range is built up of a thick series of sedimentary rocks which are intruded by large masses of granite.

Mineral Resources.

Among the known mineral resources of the county are andalusite, barytes, clay, copper, dolomite, gold, lead, limestone, molybdenum, pumice, salt, silver, travertine and zinc.

METALS.

COPPER.

The base ores that occur in the well mineralized belt that follows the Sierra Nevada range very frequently carry copper in association with other minerals and some spasmodic attempts at mining this metal have been made in the past. The principal occurrences of copper ores are on Copper Mountain sixteen miles southwest of Bodie and four miles from the west shore of Mono Lake.

In this area copper ores are found on the contact of limestone and porphyry. The ore is principally azurite, cuprite, malachite and chrysocolla. No development work has been done on these deposits since 1908 and the extent of the deposits has not been determined. The antimonial silver ores of Blind Springs carry some copper, in the form of azurite, malachite and chalcopyrite.

GOLD.

The principal production of gold in Mono County has been from the Bodie, Masonic, Lundy and Mono Lake districts. The Bodie mining district has been the most important in Mono County and has a production record of about $30,000,000 since its discovery in 1860. In this district the Standard Consolidated Mining Company's record of production from 1877 to 1913 was $18,202,855, with $5,264,407 paid out in dividends. The Southern Consolidated, which comprised the Noonday, Red Cloud, Addenda, Oro and Defiance mines, produced from 1877 to 1888, $1,048,372. The Syndicate Mine record of production was over $1,000,000. In the Lundy Mining District the May Lundy Mine has produced about $2,000,000. The most productive mine in the Masonic District was the Pittsburg-Liberty Mine, which has a production record of $700,000. Other important producing mines have been the Casa Diablo Mine, located in the Chidago District, and the Mammoth Mine, located near Mammoth in the high Sierra.



Lake Mono from the west side. Elevation 6426 feet (October, 1909, U. S. G. S.). Photo by Walter W. Bradley.

The principal gold placer areas in the county are located on the headwaters of the Walker River and on Virginia and Dog creeks, and the Bodie Diggins, located north of Mono Lake. Considerable gold was produced in the early days from the areas mentioned. The gravel in the area on Virginia and Dog creeks covers several hundred acres and is from five to ten feet thick, and said to have an average value of 25 cents per yard.

Mines.

Al Mono Mine. It is located in the West Walker River Mining District, in T. 8 N., R. 22 E., M. D. B. and M., 3 miles south of Coleville.

Bibl: State Mineralogist's Report XV, p. 165.

Blue Bird Group of Claims. It comprises 5 claims located in the Chidago Mining District, 12 miles southwest of Benton, a station on the Southern Pacific Railroad. Elevation 8500 feet. Owners, Harry M. Brown and J. F. Burchim, of Bishop, California.

A vein of quartz occurs in rhyolite, strikes northeast and dips vertically. A number of prospect holes made along the outcrop for a considerable distance have exposed a vein from 2 to 4 feet in width. Samples taken at the different openings are said to show values of $5 to $15 per ton in gold.

Bonanza Group of Claims. The group comprises five claims located in the Chidago Mining District, 4 miles north of the Casa Diablo District and 14 miles southwest of Benton, a station on the Southern Pacific Railroad. Elevation 7000 feet. Owner, Gerald Hartley, Bishop, California.

A vein of quartz 3 feet wide occurs in rhyolite. It strikes east and dips 70° south.

Development consists of a number of shafts sunk along the outcrops to depths of 10 to 20 feet. Samples taken from the different workings are reported to assay from $5 to $10 per ton in gold and silver.

Brownlie Group of Claims. The group comprises three claims located 2½ miles southeast of Masonic, in the Masonic Mining District. Owner, W. L. E. Brown, of Masonic, California. The vein occurs on contact of schist and granite. It strikes northeast and has a width of 6 feet.

Bibl: State Mineralogist's Reports XV, pp. 143, 160; XVII, p. 153; XVIII, p. 416.

Casa Diablo Mine. It comprises six claims, two of which are patented, located 22 miles north and a little west of Bishop, Inyo County, in the Casa Diablo Mining District. Elevation 7200 feet. Owner, M. Q. Watterson, Bishop, California. The property was operated in 1921 and 1922 by the Bishop Community Gold Producers Mining Company, of Los Angeles.

Three parallel veins occur in granite, known as the May Brooks, Don of Hope and Dry Bone, the most productive vein being the May Brooks. These veins strike N. 55° E. and dip 65° northwest. In width the veins vary from 12 inches to three feet. The vein quartz is stained with iron oxide and shows only a small percentage of pyrite.

The workings consist of a number of tunnels driven at different elevations. The main working tunnel is known as the May Brooks tunnel and is driven as a crosscut S. 30 E., 1000 feet, intersecting the above mentioned veins. The May Brooks vein was intersected 300 feet from the portal of the tunnel. This vein was drifted on a distance of 300 feet southwest of crosscut and 75 feet to the northeast, and was stoped for a distance of 250 feet on the southwest to the surface. About 90 feet beyond the May Brooks, the Don of Hope vein was cut by the crosscut tunnel and this vein was developed for a distance of 300 feet to the northeast and stoped for a distance of 100 feet. About 30 feet southwest of crosscut tunnel, a winze was sunk on the vein to a depth of 250 feet. Approximately 100 feet beyond this vein the crosscut tunnel intersects the Dry Bone vein.

The average value of the ore milled from these workings is reported to have been $12 per ton in gold.

Practically all the equipment, with the exception of a 10-stamp mill, has been removed from the property. Water for camp use and mill operations was secured from Rock Creek, a distance of eight miles. Idle.

Bibl: State Mineralogist's Report XVIII, p. 418.

Charlestown Mine. This property consists of 8 claims located in Sec. 36, T. 2 N., R. 25 E., M. D. B. and M., in the Mono Lake Mining District. Elevation 8700 feet. Owner, J. F. Hammond, of Mono Lake, California.

A vein of quartz occurs in slate and strikes northeast with a vertical dip. The vein quartz is 5 feet wide and is free milling.

Development consists of crosscuts and tunnels amounting to 900 feet. Idle.

Bibl: State Mineralogist's Reports VIII, p. 385; XII, p. 177; XIII, p. 227; XV, p. 172.

Chemung Mine. It is situated 2½ miles southeast of the town of Masonic, in the Masonic Mining District. Owner, Visalia Masonic Mining Company. George C. Cobb, president; Frank Carson, secretary, Visalia, California. Under lease to Burroughs and O'Brien, of Bridgeport.

Developments consist of a vertical shaft 200 feet in depth, with drifts on the 50, 100 and 200-foot levels. Three men employed in unwatering the shaft and underground workings.

Bibl: State Mineralogist's Report XVIII, pp. 415–416.

Clover Patch, Gold Lode, B. B. and Old Glory Groups of Claims. These groups comprise 52 claims, situated in T. 3 and 4 S., R. 30 and 31 E., in the Clover Patch and Chidago mining districts, located 35 miles north of Bishop and 14 miles southwest of Benton, a station on the Southern Pacific Railroad. Elevation 7000 to 8500 feet. Owner, *Universal Ore Milling and Mining Company.* Dr. E. W. Ames, president; W. H. Goodwin, secretary; W. B. Ames, general manager; Harry M. Brown, superintendent. Offices, Reno, Nevada.

Gold Lode Group comprises 16 claims; Old Glory Group comprises 19 claims; B. B. Group comprises 8 claims; Four Leaf Clover comprises 13 claims.

These claims are located along a series of parallel quartz lodes that strike N. 30° W., extending from the Casa Diablo Mine to Wildrose Canyon. The general country rock in this area consists of granite, rhyolite, quartzite, with here and there lentils of limestone. In places in this area, there are flows of andesitic tuff and some basalt. The quartz veins which occur both in granite and rhyolite are found along a series of parallel rhyolitic dikes that form the main ridges in this area, extending in a northerly direction. These veins vary in width from two to six feet.

Development consists of tunnels and shallow shafts and prospect holes along the most prominent outcrops. Samples taken from these different workings are stated to carry from $2.50 to $15 in gold and silver.

The most extensive development has been on the Old Glory Group which was formerly known as the Banner Mine. Here on the east slope of the ridge that lies east of Clover Patch, a tunnel has been driven 200 feet northwest on a vein that strikes N. 50° W. and dips 50° northeast. This vein is in granite and is from 18 inches to 3 feet in width. It is stated the ore mined from this tunnel had an average value of $10 per ton in gold and silver.

South of these workings are the main Banner workings which consisted of several incline shafts sunk on a vein that strikes N. 30° W. and dips 15° west. These workings are caved. This vein has a width of 12 inches to 3 feet. The ore was hauled by wagon to Banner Springs where it was treated in a 5-stamp mill. The vein quartz is mineralized with galena, pyrite, marcasite and chalcopyrite and carries values in gold and silver.

On the Four Leaf Clover Group the gold occurs in fractures and seams in the rhyolite, the belt of rhyolite being about 2000 feet in width with general east and west strike. It is reported that the company has taken over the *Sierra Vista Mine* and plans to install a 50-ton mill for treatment of ores in the district.

Conroy Ranch (Placer). The property comprises 400 acres of patented land located on the north shore of Mono Lake and to the west of Mono Diggings.

The gravel on this property is reported to carry values of 25 cents per yard and covers the whole area of the ranch. It is reported that the property was formely drilled for dredging ground. Richie Conroy, of Mono Lake, owner.

Dog Creek Placers. This area on Virginia and Dog creeks consists of well-rounded wash gravel, varying in depth from five to ten feet and distributed over several hundred acres of ground. It is stated that over this area the gravel will pan about 25 cents per yard. During the past year these placers have been worked by Laughlin and Rose, of Los Angeles. These parties are planning to install a shovel and also a screening and sluicing plant to work the gravels this winter.

Dunderburg Mine. It is situated one mile south of Green Creek, in Sec. 19, T. 3 N., R. 25 E., M. D. B. and M. Owner, J. S. Cain, of Bodie, California.

The vein occurs in granite, strikes north and dips 45° west. The vein is 3 to 9 feet in width and it is reported the oxidized ore above the upper tunnel carried values in gold as high as $20 to $40 per ton. The ore encountered in lower tunnel is highly mineralized with pyrite.

Development consists of three crosscut tunnels. The upper tunnel is 900 feet, and 200 feet below this tunnel there is a tunnel 1700 feet in length. About 800 feet below this latter, an adit was started on Green Creek and run 500 feet when operations were suspended. The property has been idle since 1902.

Bibl: State Mineralogist's Reports XII, p. 178; XIII, p. 227; XV, pp. 166–167.

El Dorado Group of Claims. This group of claims is located in Mammoth Lakes Mining District, 4 miles southwest of Mammoth P. O. on the west slope of the Sierra Nevada Range of mountains. Elevation 9400 feet. Holdings comprise five claims. Owners, D. F. Shively and associates, Mammoth, California.

The vein strikes northwest and dips 80° northeast. It has a width of 8 feet. The hanging wall of the vein is diorite-porphyry, with quartzite on the footwall.

Development consists of shallow shafts and opencuts along the strike of the vein.

Golconda Mine. It is situated in S½ of Sec. 36, T. 2 N., R. 25 E., M. D. B. and M., in Mono Lake District, on the east slope of the range west of Mono Lake. Idle. Owner, *Nevada-California Power Company.*

Bibl: State Mineralogist's Report XV, p. 172.

Goleta Mine. It comprises seven patented claims located in Sec. 11, T. 2 N., R. 25 E., M. D. B. and M., on the eastern slope of the Sierras, about six miles northeast of Lundy. Owner, *Goleta Consolidated Mining Company.* Elevation, 7500 to 8500 feet. Developments consist of two tunnels. The upper tunnel is 1200 feet in length, while the lower tunnel is said to be 500 feet in length. The vein quartz carries values in gold, silver and copper. Idle.

Bibl: State Mineralogist's Reports XII, p. 178; XIII, p. 228; XV, p. 172.

Golden Gate Mine. It is located in Rodriquez Canon, about three miles from Coleville, in Sec. 26, T. 8 N., R. 22 E., M. D. B. and M. Owner, Brown and Donovan, of Masonic. Two veins of quartz occur in schist, strike N. 60° E., and dip 38°. Veins vary in width from two to four feet. Developments consist of five tunnels from 300 to 1800 feet in length. Idle.

Bibl: State Mineralogist's Report XV, pp. 140–142 and p. 165.

Gold Wedge Mine. It comprises nine claims located on the east slope of the Benton Range of mountains, 11 miles southwest of Benton. Owner, Joseph Main of Benton, California. Under bond and lease to R. E. Davis and J. A. Mayer, of Bishop, California. There are two systems of veins on the property. One strikes N. 20° E., and dips 50° west. The other strikes east and dips north. These veins occur in schist and are from two to four feet in width. The vein quartz is mineralized with pyrite, galena, marcasite and carries values in gold and silver. On a ridge, at an elevation of 7100 feet, a tunnel has been driven south 175 feet on the N. 20° E. vein. At 150 feet from the portal, the tunnel intersected an east and west vein and a drift has

been driven 40 feet east on this vein. The vein worked was 18 inches in width. Eighty-four tons was shipped from these workings which it is stated carried 50 oz. in silver and $8 per ton in gold. At an elevation of 6800 feet a crosscut tunnel is being driven south to intersect these veins. The tunnel is in 300 feet. On the north side of the canyon are several tunnels 50 to 100 feet on a vein that strikes N. 20° E. and dips 50° west. Six men are employed.

Headlight and Monte Cristo Mine. This property comprises six claims located in the Mammoth Lakes Mining District, 4½ miles southwest of Mammoth. Elevation 9100 feet. Owner, P. Reddy Estate, of San Francisco. Under option to *Mammoth Consolidated Mines Company*, Terminal Subway Building, Los Angeles.

These mines are situated on a ridge north of Mammoth Creek and are located between the Mammoth and Lisbon mines.

Development consists of a crosscut tunnel driven west 1500 feet, at a depth of 800 feet below the surface.

It is stated that a vein of low grade quartz was cut at a distance of 1200 feet from the portal. Idle.

Bibl: State Mineralogist's Reports VIII, p. 375; X, p. 341; XII, p. 181.

Hermine Mine. It comprises one claim situated in the Masonic Mining District, in Sec. 15, T. 6 N., R. 26 E., M. D. B. and M. Owner, Mrs. Homer Grigsby, Masonic, California.

Bibl: State Mineralogist's Report XV, p. 164.

Home View Mine. It is situated in the Masonic Mining District, in Sec. 15, T. 6 N., R. 26 E., M. D. B. and M., north of the Pittsburg Liberty Mine. Tunnel driven south 900 feet in granite. Idle.

Bibl: State Mineralogist's Report XV, p. 164.

Hornet Group of Mines. This group is located 8 miles southwest of Benton in the Benton Range of mountains, south of the Tower Mine. The property was formerly known as the *Yellow Jacket Mine.* Holdings comprise four claims. Owners, Harry M. Brown and J. F. Burchim of Bishop, California. Elevation, 6350 feet. The main Yellow Jacket vein strikes N. 30° E., dip vertical. Width 2 to 4 feet. The vein occurs on the contact of schist and granite. There is also a vein in granite that strikes east and dips 50° north. This vein has a width of 2 feet. Development consists of a shaft 150 feet deep and a number of tunnels and shallow shafts. Idle.

Lake View Mine. It comprises one claim, situated in Sec. 20, T. 26 N., R. 26 E., in the Masonic Mining District. Owner, J. M. Bryan Estate of Masonic. Development consists of a tunnel 175 feet in length with winzes and raises on the vein. Idle.

Bibl: State Mineralogist's Report XV, pp. 164–165.

Leida Group of Mines. This group of mines is situated two miles west of Deer Springs, and 12 miles southwest of Benton, in the Benton Range of mountains and in the Chidago Mining District. Holdings comprise 16 claims. Owner, Louis Leida of Benton, California. Elevation 8000 feet. A series of parallel veins occur on these claims, which



Photo showing Mammoth Consolidated Mines Company's property.

strike northwest and dip 50° southwest, in granite. The veins have a width of 3 to 6 feet. Development consists of a number of tunnels and open cuts along the outcrops. Two men employed.

Lisbon Mine. It comprises a group of 8 claims located on the ridge northeast of Mammoth Creek, in the Mammoth Lakes Mining District, about 5 miles southwest of Mammoth P. O. Elevation 9500 feet. Owners, Earl C. Dart and Frank Butler, of Mammoth. This, with the Mammoth Mine, was one of the original producers from 1878 to 1884.

The vein is from two to six feet wide, and strikes N. 30° E. and dips 70° southeast. The vein was developed by three tunnels about 100 feet apart. It is stated that Lisbon vein faults the Mammoth vein. The ore was free-milling gold quartz, with more or less auriferous pyrite. The ore was formerly treated in a 5-stamp mill, located below No. 3 tunnel. Workings caved.

Log Cabin and Sunrise Group of Mines. This group of mines comprises 17 claims located in Sec. 1, T. 1 N., R. 25 E., M. D. B. and M., on the east slope of the Sierra Nevada Range and 2½ miles west of Mono Lake. Owners, J. R. Simpson and Luther Brown, of Los Angeles. Elevation, 9000 feet. The country rock is a metamorphic slate and quartzite. On the Log Cabin group, which comprises five claims, there are five parallel veins that strike north. Several of these veins dip 70° east. The others dip 45° west. The widths of the veins vary from 2 to 3 feet.

Development consists of shafts and tunnels. The lower tunnel is driven south 700 feet, and 400 feet in elevation above this tunnel is another tunnel driven south 160 feet and about 1000 feet east of this tunnel at a higher elevation are two shafts; one 100 feet deep and the other 250 feet in depth. This latter shaft was sunk in the footwall. On the 100-foot level a drift runs north on the vein for a distance of 60 feet. There is also a crosscut driven east on the 100-foot level 100 feet, which cuts three parallel veins whose average width is four feet, and it is stated that ore from these workings carried $10 to $20 per ton in gold. There are a number of other shafts from 50 to 100 feet in depth. The ore is oxidized quartz, showing free gold and some hematite. On the Sunrise Group of Claims, which are located on the east slope of the ridge overlooking Mono Lake, there are two systems of veins. One strikes east and west; the other north and south. The country rock is limestone, with thick beds of shale and slate. The north and south vein dips 45° west and most of the development work has been confined to this vein.

Development consists of four tunnels. The lower tunnel is driven S. 20° W., 600 feet and at 400 feet cuts the east and west vein. The vein quartz carries values in gold, silver and lead. The hanging wall of the vein that strikes north is slate, with a limestone footwall. The vein is two to three feet in width. At an elevation of 300 feet above this tunnel, there is a tunnel driven south on the vein a distance of 100 feet. The ore from these workings is stated to carry $12 per ton in gold, 40 ozs. in silver and 20 to 40% in lead. About 80 feet above this tunnel, there is a shaft sunk on the vein to a depth of 30 feet and a tunnel 50 feet in length is driven on the vein. The vein here is four to five feet wide. Above these workings is another tunnel, driven south 70 feet to an east and west vein, which has a width of two feet, and is reported to carry high values in gold.

Equipment consists of a 2-stamp mill and bunk house. Four men are employed on development.

Bibl: State Mineralogist's Report XV, p. 171.

Lost Horse Mine. It comprises one claim situated in Sec. 20, T. 6 N., R. 26 E., M. D. B. and M., in the Masonic Mining District. Owner, J. D. Martin, of Masonic. Shaft 50 feet deep and trenches along an iron-stained outcrop of quartzite. Idle.

Bibl: State Mineralogist's Report XV, p. 164.

Mammoth Mine. It is situated in the Mammoth Lakes Mining District, in Secs. 9 and 10, T. 15, 16 S., R. 27 E., M. D. B. and M., 4 miles southwest of Mammoth P. O., on the west slope of the Sierra Nevada range of mountains. Elevation 9000 to 10,000 feet. Owner, *San Francisco and Fresno Land Company*, of San Francisco, California.



Outcrop of vein. Mammoth Consolidated Mining Co., Mammoth, Mono County.

Under option to the *Mammoth Consolidated Mines Company*, 1241 Terminal Subway Building, Los Angeles. E. S. Gillette, president; A. G. Mahan, Jr., secretary; A. G. Mahan, general manager.

Holdings formerly comprised five claims known as Folk, Armstrong, San Francisco, Big Bonanza and Mammoth, two of which are patented. The property was operated by the *Mammoth Mining Company*, of San Francisco, from 1878 until 1881. The production during this period amounted to $200,000 in gold. The Mammoth vein occurs in crystalline rocks, evidently due to alteration of the slates and has a general northwesterly course, dipping 70° to 80° to the northeast. The surface croppings show the vein to be over 100 feet in width. The gold is reported to occur in bunches and spots, and the vein material is mineralized with magnetite, oxides of iron, auriferous pyrite, chalcopyrite, sphalerite and native gold. The bullion produced from this mine when under operation is reported to have been valued at $7 to $16 per ounce.

The underground workings consist of four tunnels, all over 1500 feet in length. The orebody is developed to a depth of 1000 feet below

the outcrop. The orebody that was worked between tunnels No. 2 and No. 3 is stated to have been 14 to 40 feet in width. The orebody worked was 500 feet above No. 4 tunnel. The present development work on the property is being confined to cleaning out and retimbering tunnels No. 2 and No. 3. Tunnel No. 3 which is driven S. 30° E. encountered the vein 800 feet from the portal and followed the hanging wall for a distance of 700 feet. Two upraises connect with a large stope which extends to No. 2 tunnel 200 feet above No. 3 tunnel. It is stated that samples taken from this stope carried $9 per ton in gold. There is an intermediate level 50 feet below No. 2 tunnel, and here is a stope 240 feet in length, and 30 feet wide. This stope is 240 feet from the portal of No. 2 tunnel.

The principal development operations of the company are confined to seven claims known as the Friendship Group, which are located on the ridge northeast of Mammoth Creek about 1½ miles southwest of the Mammoth Mine. The first discovery of high grade gold ore was made by D. F. Shively, of Mammoth, in 1918, and these claims were taken over by the Mammoth Consolidated Mines in August, 1927, and active development work started.

The principal rocks of this area are dioritic porphyry, and belts of crystalline rocks to the north and south of Mammoth Creek, with granite to the south. The top of the ridge is capped with andesite. The mineralization is principally confined to a belt of crystalline rocks which is about 500 feet wide and has a general northwest course.

The gold values are found along fractures in this belt of crystalline rock.

On this group of claims, a crosscut tunnel is being driven N. 55° E. At the time of visit the tunnel was in 75 feet. The rock in this tunnel is highly silicified and heavily mineralized with pyrite, phyrrhotite, sphalerite and some chalcopyrite.

On Friendship No. 5 Claim, which is located north of Mammoth Creek Falls, there is a vein of quartz 6 to 8 feet wide, which occurs in an andesite-porphyry, that is mineralized with argentite, pyrite and sphalerite. It also shows some native silver. Samples taken from this vein are reported to carry 17 ozs. in silver and $8 per ton in gold.

Equipment consists of a 250-cu. ft. Ingersoll-Rand compressor, blacksmith shop, cars and air drills. Fifteen men are employed.

Bibl: State Mineralogist Report VIII, pp. 373–375.

Mary B. Group of Claims. It comprises four claims situated in the Chidago Mining District, in the Benton range of mountains, 12 miles southwest of Benton. Owners, Harry Brown and J. F. Burchim, of Bishop, California. The country rock is rhyolite. A vein of quartz from 4 to 6 feet in width strikes east and dips 60° north. The only development consists of shallow shafts and open-cuts on the outcrop of the vein. Idle.

May Lundy Mine (Crystal Lake). It is situated on the south slope of Mount Scowdon, in Sec. 30, T. 2 N., R. 25 E., M. D. B. and M., five miles south of Lundy and six miles west of Mono Lake P. O. in the Homer Mining District. Elevation, 9500 to 12,500 feet. Owners, Thomas Hanna and R. T. Pierce, of Martinez, California. The deposit was discovered in 1879 and operated continuously from that

date until 1898. Since then it was operated at intervals until 1914. The total production is reported to have been from $1,700,000 to $2,000,000. Holdings comprise one patented claim and about 20 claims held by location.

The country rock is slate and hornblende granite. Two veins, known as the May Lundy and West veins, occur in hornblende granite. These veins strike northwesterly and dip 45° to 50° southwesterly and are 2 to 4 feet wide. The lode is developed by a number of tunnels, drifts, shafts and winzes. Tunnels No. 1, No. 2 and No. 3 were driven on the lode, the latter being over 1000 feet in length. The Lake View crosscut tunnel, 3100 feet in length and 200 feet in elevation below, is the main adit tunnel which is 3900 feet in length, and cuts the May Lundy Vein 1500 feet below the outcrop. The vein quartz carries free gold and some pyrite. There is a 20-stamp mill on the property, situated near the main adit. Idle.

Bibl: State Mineralogist's Reports VIII, p. 371; XII, p. 180; XIII, pp. 228–229; XV, pp. 170–171.

New Bodie (Syndicate) Mine. It is situated in the Bodie Mining District, and adjoins the Standard Consolidated Mining Company's holdings on the north. Idle.

Bibl: State Mineralogist's Reports VIII, p. 387; XII, p. 184; XIII, p. 232; XV, pp. 159–160; Report of the Director of the U. S. Mint, 1883, p. 175.

New York Mine. It is situated in the Masonic Mining District, and adjoins the Serita Mine. Idle.

Bibl: State Mineralogist's Report XV, p. 164.

Paragon Group of Claims (Gold). This group is situated in the Indian Mining District, 8 miles south of Benton. Elevation 7750 feet. Holdings comprise 5 claims. Owners, George L. Wallace and S. N. Looney, of Benton.

The vein occurs as a prominent outcrop of quartz, having a width of 30 feet. It strikes north and dips 80° west. The country rock is granite and rhyolite.

A sample taken across 30 feet is reported to carry $7 per ton in gold. Development consists of two tunnels; the upper tunnel is driven south a distance of 50 feet, about 50 feet below the outcrop. About 25 feet below this tunnel, the lower tunnel has been driven as a crosscut in the granite footwall 100 feet to the vein. The property was formerly owned by Pat Ready and is reported to have had some production.

Parrett Mine. It is situated in Sec. 19, T. 2 N., R. 25 E., M. D. B. and M., one mile west of Lundy and eight miles northwest of Mono Lake post office. Holdings comprise 11 claims. Owner, Hillis Parrett, of Mono Lake, California. Idle.

Bibl: State Mineralogist's Reports XII, p. 182; XIII, p. 230; XV, p. 172

Pittsburg-Liberty Mine. It comprises four claims, known as Pittsburg, Liberty, Liberty No. 2 and Pittsburg No. 2, located in Secs. 21

and 22, T. 6 N., R. 26 E., M. D. B. and M., in Masonic Mining District, 12 miles northeast of Bridgeport. Elevation 8000 feet. Owner, *Valley View Mining Company,* Reno, Nevada.

Five parallel veins occur in schist, strike N. 25° W., dip 70° to 90° east.

Developments consist of a shaft 172 feet deep and two tunnels cutting the veins at a depth of 271 feet and 413 feet. The total amount of development consists of 6000 feet of underground workings. The property is reported to have a production of $700,000.

Equipment consists of 100-hp. gas engine and 60-ton mill and cyanide plant. Idle.

Bibl: State Mineralogist's Report XV, pp. 161–162.

Rancheria Placers. It comprises 160 acres located 6 miles west of Mono Lake. Elevation 7300 feet. Owner, W. R. Hunnewell, Bridgeport, California. Under option to *Sin Placer Mining Company,* of Los Angeles. H. B. Franks, Richard Ward and F. M. Keyser. Besides the 160 acres held under option, the company has located a number of other claims.

The Cinnamon cut is located on the Hunnewell property. This cut is 1700 feet in length by 200 feet wide and 75 feet deep. The gravel was washed in former days by water secured through a ditch from Virginia Creek, and it is reported that the production of gold from this cut was over $80,000. The source of the gold in this area is from ledges and stringers, as the gravel is fine and more or less angular, with no boulders.

In Rancheria Gulch, a number of shafts have been sunk to depths of 30 to 40 feet to bedrock in the center of the gulch. The gravel is said to run from 25¢ to 80¢ per cu. yd. The area in which the placers are located was known as Bodie Diggings.

Red Rock Mine. It is located in Sec. 20, T. 6 N., R. 26 E., M. D. B. & M., in the Masonic District, 12 miles northeast of Bridgeport. Owners, J. D. Martin, Robert Batcher, Verne Smith, of Santa Rosa, California.

Developments consist of shaft 50 feet deep and several tunnels about 25 feet in length. Idle.

Bibl: State Mineralogist's Report XV, p. 165.

Reo Group of Claims. It comprises eight claims located one mile north of the Sierra Vista Mine, in the Chidago Mining District. Elevation 7450 feet. Owner, R. J. Hess, of Bishop, California. Under option to G. Blakemore and associates, of Reno, Nevada.

The vein strikes N. 20° W. and dips 80° west, and has a width of 3 feet. The hanging wall of the vein is schist, with rhyolitic porphyry on the footwall.

Developments consist of shallow shafts and short tunnels. Idle.

Rough and Ready Mine. It is situated in the Masonic District, 12 miles northeast of Bridgeport. Developments consist of two tunnels 300 and 350 feet in length. Idle.

Bibl: State Mineralogist's Report XV, p. 164.

Sacramento Mine. It comprises four claims located on the west slope of the White Mountains, 11 miles north of Laws and 3 miles northeast of Chalfant Siding, on the Southern Pacific Railroad. Elevation 6000 feet. Owner, Chas. Gifford, of Laws, California.

The vein occurs in granite, having an east and west course, and dips 30° north. The width varies from 18 inches to 4 feet.

Development consists of a tunnel 300 feet long, and below this tunnel there is an adit about 100 feet in length. At a higher elevation on the mountain, an incline shaft was sunk on the vein to a depth of 300 feet. A considerable amount of ore was stoped from shaft workings and some ore has been stoped above the main tunnel level. The vein is oxidized gold quartz. The gold is found evenly distributed and is mostly free. Idle.

Bibl: State Mineralogist's Reports XII, p. 183; XIII, p. 230.



Sierra Vista Mine, Benton, Mono County.

Scrita Mine. It is situated in Sec. 21, T. 6 N., R. 26 E., M. D. B. and M., and one-half of a mile west of the Pittsburg-Liberty Mine, and 12 miles northeast of Bridgeport, in the Masonic Mining District. Elevation 8000 feet. Owners, F. W. Stall and George C. Stall, of Masonic.

The development consists of a vertical shaft 220 feet deep and two crosscuts on the 100-foot level, one driven north 100 feet, the other south 85 feet. The orebody developed is from 4 to 10 feet wide and it is stated that the value in free gold ranges from $3 to $40 per ton. Idle.

Bibl: State Mineralogist's Report, p. 162.

Sierra Vista Mine. It is situated in the Chidago Mining District, in T. 3 S., R. 31 E., M. D. B. and M., on the west slope of the Benton Range of mountains, 11 miles southwest of Benton. Elevation 7300 feet. Owner, *Sierra Vista Mining Company.* H. M. Warren, president; R. I. Lamothe, secretary, Los Angeles. The property has recently been taken over under option by the *Universal Ore Milling and Mining*

Company, of Reno, Nevada. Dr. E. W. Ames, president, and W. B. Ames, general manager. This company plans the installation of a fifty-ton mill for treatment of the Sierra Vista ores, also to be used for custom mill on the ores of the district. The Sierra Vista Mining Company operated the property in 1926, but operations were suspended in the early part of 1927, due to the destruction of the company's 25-ton mill by fire.

There are three parallel veins on the property that strike N. 10° W. to N. 45° W. and dip southwest 40°. These veins vary in width from 2 to 8 feet. The formation is rhyolite and metamorphic limestone, with diorite intrusions. The Sierra Vista or West vein is the only vein that has been developed to any extent. This vein occurs on contact of metamorphic limestone and a rhyolitic porphyry, the former being the hanging wall of the vein and the latter the footwall. This vein strikes N. 10° W., dips 40° west and is from 2 to 4 feet wide. It has been developed by three tunnels. The main, or lower tunnel, has been driven east as a crosscut 500 feet. At 300 feet from the portal, the vein was cut and drifted on 150 feet north and 180 feet south. The vein has been stoped to the surface in the south drift for a length of 150 feet. In the north drift, a number of raises have been put up on ore.

The vein material is quartz-porphyry, with iron oxide streaks running through. The ore is free-milling, and is said to carry from $6 to $20 per ton. When the mill was under operation, the heads carried 0.72 ozs. in gold, 1.88 ozs. in silver, with 0.5 to 3% lead.

At 50 feet in elevation above this tunnel, there is a crosscut tunnel driven east 100 feet to the vein, with a drift north on the vein 200 feet.

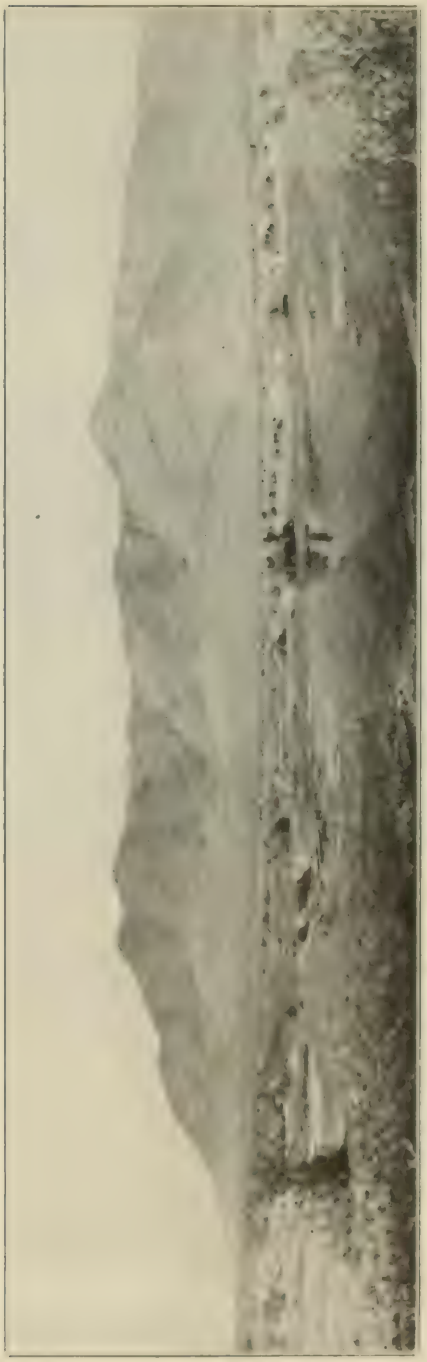
The upper tunnel is 50 feet above these workings and has been driven east 60 feet to the vein, with drifts north and south on the vein for a total distance of 100 feet. At an elevation of 7600 feet is what is known as the Pink Monster vein, which occurs in rhyolite and strikes northwest. This vein is about 8 feet wide. It has been developed in a gulch to the north by a tunnel 200 feet in length.

Equipment consists of 75-h.p. Semi-Diesel Y type Fairbanks-Morse gas engine; Reliable ball mill, capacity 25 tons. Two men employed.

Standard Mine. It is located at Bodie, and has been the most productive mine of the district. Owner, *Standard Consolidated Mining Company*. J. S. Cain, of Bodie, California.

The holdings of the company comprise about 200 acres. Besides the original Standard Claims, the following old companies were absorbed in 1895: Bodie, Bulwer, Mono and Summit, and the Bodie tunnel was purchased in 1901, the company owning practically all the land between the New Bodie and the Southern Consolidated.

The property was an active producer from 1877 to 1914, the production amounting to $18,202,856, during which period the company paid out $5,264,407 in dividends. There is no record of production from 1860 (when the Bodie Mining District was organized) to 1877. The principal development on the property was carried on through the Lent and Standard shafts, these shafts being 1200 feet deep. The



Blind Springs Hill, Bodie, Mono County. Photo by Chas. A. Palmer.

property has been worked off and on by leasers since active development operations were suspended about 1917. Idle.

Bibl: State Mineralogist's Reports VIII, p. 385; XII, p. 183; XIII, p. 231; XV, pp. 150–158. Director of U. S. Mint, 1883, pp. 173–175.

Success Mine. It is situated in the Masonic Mining District, one mile south of the Chemung Mine, 9 miles northeast of Bridgeport. This property consists of two claims. Owners, John H. Hayes and C. C. Hayes, of Bridgeport. Under bond and lease to L. W. Dye, of Masonic, California.

The vein strikes northeast and dips to the east. The country rock is andesite. The vein has a width of 3 feet and is said to carry $11 per ton in gold. Idle.

Bibl: State Mineralogist's Report XVIII, p. 416.

LEAD, SILVER AND ZINC.

The earliest mining in Mono County was that of silver ores in the Benton District, situated in the southeastern portion of the county.

The discovery of silver ore on the Cornucopia, Diana and Comanche veins on Blind Springs Hill, in 1862, was followed by a period of activity in production of silver from the Benton District, dating from 1862 to 1889. The total value of the production from the mines of the Benton District during this period was $4,215,869. The other productive mining districts in the neighborhood of Benton were known as the Indian, Clover Patch and Chidago districts, about 8 to 12 miles southwest of Benton.

Lead occurs associated with the silver ores of these districts in the form of cerrusite and galena.

More than one-half of the output of Blind Springs Hill, namely, $2,200,000, was produced by three mines, the Comanche, Diana-Kerrick and Cornucopia. The other important productive silver district is known as the Patterson District, situated north of Bridgeport on the eastern slope of Sweetwater Mountains. The most productive mines were the Kentuck and Silverado.

The ores of the Blind Springs Hill District are complex associations of antimonial ores of copper, lead and silver, with small amounts of gold. The minerals in the ores are pyrite, chalcopyrite, bornite, tetrahedrite, sphalerite, galena, argentite, pyrargyrite, stephanite, kerargyrite, native silver, partzite, anglesite and cerussite. The ore minerals found in the lodes of the Patterson District are argentite, kerargyrite, pyrite and small amounts of native gold, associated with magnetite and iron oxides.

Silver also occurs associated with the gold ores of the Bodie and Mammoth districts in appreciable amounts. Deposits of lead-zinc ores occur in the narrow belts of crystalline limestone on the western slope of the Sierra, the principal occurrences being in the vicinity of Gull, June and Virginia lakes.

The most noteworthy mining development in progress in the county in recent years is being done by the *Comanche Mining and Reduction Company*, of Los Angeles. At an elevation of 5400 feet, on the east



Portal of tunnel of the Comanche Mining and Reduction Co., Baxter, Mono County. Photo by Chas. A. Palmer.

slope of Blind Springs Hill, a crosscut tunnel is being driven east to cut the Cornucopia, Diana-Kerrick and Comanche lodes. This tunnel will intersect these veins at a vertical depth below the outcrop of 1200 feet. The other important development work is on the Silverado Mine, in the Patterson Mining District, by the *Mono Mining Company,* of Chicago, Illinois. During the past year this company has spent a large amount of money in equipping the property with a power plant and the installation of a tramline from the mine to its new 100-ton cyanide plant.

Mines.

Banner Mine. (Gold-Silver.) It is situated 12 miles southwest of Benton, in the Chidago Mining District, and is now located as *Old Glory Group of Mines.* Holdings comprise 19 claims. Elevation 8000 feet. Owner, *Universal Ore Milling and Mining Company,* of Reno, Nevada.

The property was operated from 1870 until 1884. A small mill was built at Banner Springs and operated until 1884. The Banner lode strikes N. 40° W. and dips 15° southwest in granite. The vein was worked by several small incline shafts to a depth of about 150 feet, on the slope of the vein. Workings caved.

It is reported the Banner lode carried a notable content in gold, and it is reported that the bullion produced was about 700 fine in gold and 300 fine in silver. The present owner plans to do some development work on the property this year. Idle.

Comanche Mining and Reduction Company. Charles H. Palmer, president; C. H. Weaver, secretary; D. C. Palmer, superintendent. Offices, California Building, Los Angeles.

This company during the past six years has acquired all the property of the Blind Springs Mining Company, on Blind Springs Hill, which is situated 4 miles southeast of Benton. The holdings of the company comprise the Boraska, Comanche, Cornucopia, Kerrick-Diana and Hudson Group of Claims, consisting of 36 patented claims and 12 locations, amounting to 1660 acres, also 240 acres of patented land in Benton Valley, east of Blind Springs Hill, where the camp is located.

For the past six years this company has carried on active development work on the Comanche and Kerrick mines and is at present driving a 7′ by 9′ crosscut tunnel from the east side of Blind Springs which will intersect the productive lodes of the hill at a vertical depth of 1000 to 1200 feet.

Blind Springs Hill is six miles in length. The mineral-bearing zone is from 2 to 3 miles in length from north to south and about 1½ miles in width from east to west. The formation of the hill is a hornblende granite. The veins or lodes are a series of parallel fault fractures which strike N. 10° W. to N. 20° W., with varying dips to the east from 45° to 82°.

The principal developed mines are the Diana-Kerrick, which has 4700 feet on the Diana-Kerrick Vein. This, with the Comanche vein system, constitutes the most westerly group of mines. The next easterly group of veins is the Anderson, Cornucopia, Lyford and Borasca. All the

veins, with the exception of the Comanche, dip from 30° to 45° to the east.

The Comanche Vein dips 82° east, having a width of from 7 to 8 feet. This vein has been worked through the Comanche Shaft to a depth of 750 feet and has been the most productive vein on Blind Springs Hill, having a reported production of $1,000,000.

The present development work is confined to the Kerrick Shaft on the Diana-Kerrick Vein. The Diana Shaft is located 1500 feet south of the Kerrick Shaft. This shaft was sunk on the vein to a depth of 800 feet, and the vein stoped south to the Kerrick end line from the 800-foot level, a distance of 900 feet. The elevation of the Diana Shaft is 6800 feet. The Diana-Kerrick Vein strikes N. 10° W., and has an average dip of 47° to the east. The width of the vein varies from 18 inches to 4 feet. The orebodies occur as irregular lenses of antimonial copper-lead-silver ore carrying from 20 to 150 ounces in silver per ton, with



Kerrick shaft. Comanche Mining and Reduction Company, Benton, California.

from 20¢ to $2 per ton in gold. At an elevation of 6600 feet, the Kerrick Shaft was sunk on the vein by former operators to the 650-foot level, where it was cut off by a fault which strikes N. 50° W., and dips 85° south. The vein was stoped both north and south of shaft to the surface from this level and it is reported was worked as far south as the Diana-Kerrick end line. The production of ore from the Diana-Kerrick mines is stated to have been about $900,000.

The Kerrick Shaft has been sunk by this company from the 650-foot level to the 950-foot level, the shaft being in the hanging wall of the vein to the 750-foot level where the vein was encountered. From this point, the shaft is on the vein to the 950-foot level. The vein was step-faulted a distance of 30 feet. On the 850-foot level the vein has been drifted on 215 feet to the south and 175 feet to the north. On the east slope of Blind Springs Hill, at an elevation of 5400 feet, a 7′ by 9′ crosscut tunnel has been driven S. 49° W., 3500 feet. At this point the course of the tunnel turns due west for 300 feet and it is stated that the tunnel will intersect the Diana-Kerrick Vein at 4250 feet from the

portal, at a point 300 feet south of the Kerrick incline shaft. This tunnel level gives a 1200-foot vertical depth below the outcrop of the Diana-Kerrick Vein.

Equipment at the Kerrick Shaft consists of a 300-cu. ft. Ingersoll-Rand compressor and a 25-h.p. single drum gasoline-driven hoist.

At the main tunnel level the equipment consists of two (14″ by 9½″ by 14″) Chicago pneumatic compressors, Sullivan drill sharpener, No. 8 Buffalo blower, driven by a 15-h.p. Fairbanks-Morse gas engine, and a blacksmith shop. Twenty-five men are employed.

Bibl: State Mineralogist's Report VIII, p. 376.

Cooney Zinc Mine. (Lead-Zinc.) It comprises 14 claims, located 5 miles southwest of Virginia Lakes Service Station, and about 14 miles south of Bridgeport. Elevation 9400 feet. Owners, A. W. Ahrens, Mrs. Bertha Hall and J. Cooney, of Bishop, California. Under option to Fred Knapton, J. Edward Rose and C. N. Rose, of Bishop, California.

The surface croppings are heavily iron-stained and the minerals contained are hornblende, pyroxene, epidote and garnet. These croppings occur in limestone and strike northwest. The outcrop is several hundred feet wide. A tunnel has been driven 120 feet southwest under this outcrop. At 30 feet from the portal, a lead-zinc sulphide orebody 40 feet wide was cut and samples taken over this 40-foot area are reported to carry 18% zinc and 10% lead, with 4 to 6 ozs. in silver per ton. The ore is sphalerite and galena, very closely associated.

At a higher elevation a shaft has been sunk in the center of the outcrop to a depth of 25 feet. At 10 feet below the collar of the shaft, lead-zinc sulphide ore was encountered. The orebody is a typical replacement deposit in limestone and from the extent of the surface croppings, the possibilities appear favorable for the development of a large body of ore. Idle.

Independence Mine. (Silver.) It comprises three claims situated 10 miles southwest of Benton, on the east slope of the Benton Range of mountains. Elevation 5750 feet. Owner, Joe Main, of Benton, California.

A massive outcrop of iron-stained quartz occurs in limestone. The vein strikes N. 30° W. and dips 40° east. A tunnel has been driven east 75 feet about 50 feet below the outcrop and a drift run south on the vein a distance of 90 feet. The vein in this drift is 4 feet wide. To the east of this outcrop a shaft has been sunk on a parallel fissure to a depth of 150 feet. North of these workings, the vein has been exposed by opencuts for several hundred feet. The ore carries values in silver with a small percentage of lead. Idle.

Huebner Group of Mines. (Lead-Silver.) It comprises a group of six claims situated in the Chidago Mining District, in the Benton Range of mountains, 12 miles southwest of Benton. Elevation 6800 feet. Owner, Julius Huebner, of Bishop, California.

Two parallel veins occur in granite, strike N. 10° E., and dip 70° east. Widths vary from 2 to 4 feet. The vein quartz is mineralized with pyrite, marcasite, galena and iron oxide. The principal values are in lead and silver, with $2 to $5 per ton in gold.

The main development has been on the east vein, on which an incline shaft has been sunk to a depth of 125 feet.

Equipment consists of a 6-h.p. Fairbanks-Morse hoist. Idle.

King Group of Mines. (Lead-Silver.) It comprises a group of six claims, situated in the Chidago Mining District, 10 miles southwest of Benton, in the Benton Range of mountains. Elevation 7450 feet. Owner, John King, of Benton, California.

A series of parallel veins occurs in the granite to the east of a rhyolite dike. The veins strike N. 30° E. and dip 50° west. The widths vary from 2 to 4 feet.

The principal amount of development is on one of the easterly veins. At an elevation of 7450 feet an incline shaft has been sunk on the vein to a depth of 100 feet and the vein has been stoped from the 50-foot level to the surface north and south of the shaft. About 300 feet south of this shaft and 100 feet in elevation below it, a crosscut tunnel has been driven 200 feet southwest to the vein, with drifts north and south on the vein. The vein quartz is mineralized with pyrite, marcasite and galena. The principal values in the ore are gold and silver, and occasional bunches of pure galena occur in the vein. One man is employed.

Lemont Group of Claims. (Lead-Zinc.) This group comprises 32 claims, located in Sec. 15, T. 2 S., R. 26 E., M. D. B. and M., on the ridge north of Gull Lake and 62 miles northwest of Laws, a station on the Southern Pacific Railroad. Elevation 7500 to 8000 feet. Owners, L. R. Montegue, F. C. Parmalee, C. W. Van Loon and H. A. Van Loon, of Bishop, California.

Lead-zinc sulphide ore occurs in a belt of metamorphic, crystalline limestone. This belt is about one mile in width with a general northwesterly course. The main ore occurrence is found along fissures in the limestone and along the bedding planes. The principal metamorphic minerals are hornblende, pyroxene, olivine, epidote and garnet, which have been replaced along the fissures by sphalerite and galena. In a small opencut there is exposed 3 feet of lead-zinc sulphide that occurs along a N. 40° W. fissure. It is stated that samples taken from this point carried 20% lead and 17% zinc, with 5 ozs. in silver per ton. At a higher elevation, a short tunnel has exposed 4 feet of lead-zinc sulphide ore along a N. 40° W. fissure. About 300 feet northwesterly from first opencut, galena and sphalerite are disseminated in the metamorphic limestone over an area 200 feet in width and 400 feet in length. On the west end of this group of claims, along the transmission line of the Southern Sierras Power Company, an opencut exposes 12 feet of limestone mineralized with sphalerite. A general sample taken over 12 feet is stated to carry 10% zinc. A general sample taken from ore extracted from the tunnel and lower opencut carried 20.7% lead, 13.9% zinc and 4 ozs. in silver per ton. Several men are employed on development work.

Lone Star Mine. (Lead-Silver.) It comprises seven claims known as the St. Ives Group, situated in the Chidago Mining District, 12 miles southwest of Benton. Elevation 7100 feet. Owner, *Lone Star Mining Company*, Reno, Nevada. Jacob H. Walker, president; S. J. Kistler, of Allentown, Pa., secretary; and G. B. Hartley, superintendent.

The vein strikes N. 15° W. and dips 80° west in rhyolite. Vein quartz is mineralized with pyrite, galena and marcasite, carrying values in silver and gold. The width of the vein varies from 18 inches to 3 feet.

Development consists of a two-compartment vertical shaft to a depth of 125 feet, then sunk on an incline of 80° for a distance of 185 feet. The vein has been drifted on the 125, 245 and 300-foot levels. On the 300-foot level, the vein has been drifted on 250 feet north and south of the shaft. There is also a crosscut east 770 feet. From the 125-foot level to the surface, a shoot of lead-silver ore has been developed 90 feet long with an average width of 3 feet. It is said that the average value of the shoot of ore is 17% lead, 26 ozs. silver per ton and $10 to $20 per ton in gold. From the 300-foot level to the 45-foot level, there is reported to be 15,000 tons of ore developed that will have an average value of $12 per ton.

Equipment consists of 40 h.p. Fairbanks-Morse single drum hoist; 250-cu. ft. Chicago pneumatic compressor. The company is planning to install a 50-ton mill for the treatment of the ore developed. Five men are employed on development work.

Lyford Mine. (Lead-Silver.) It is situated on the east slope of Blind Springs Hill, 4 miles east of Benton, and adjoins the Barasca group on the south. Elevation 6400 feet. Holdings comprise five claims known as East Side, East Side No. 1, Valley View, Grand View and Buena Vista. Owner, W. H. Davis, of Benton, California.

The Lyford vein strikes N. 15° W. and dips 20° to 35° east. Width of vein varies from 12 inches to 3 feet. The formation is hornblende-granite. The orebody has been developed by a number of tunnels driven at different elevations. The main tunnel is 400 feet in length, with two other shorter tunnels above from 100 to 250 feet in length. The Lyford Vein is faulted by a dike or a fault which strikes N. 45° W., and dips north. This fault is 50 feet wide, the filling being a breccia, with nearly white clay casings, showing slickenside surfaces and striations. The ore cut in the tunnel is made up to the fault. At same elevation as this tunnel and to the north, a crosscut tunnel is driven west in the granite 500 feet. This tunnel was evidently driven west to cut the Diana-Kerrick Vein, but work was suspended before reaching this vein.

The orebodies worked occur in irregular lenses or masses, and these rich bunches are found on either the hanging wall or footwall of the vein. The minerals observed in the ore of the Lyford are similar in character to the ore of the other mines on Blind Springs Hill, being pyrargyrite, stephanite, magnetite and cerussite. The reported production of this mine is about $200,000. One man is employed on development.

Bibl: State Mineralogist's Report VIII, p. 382.

Pat Reddy Mine. (Silver.) It comprises six claims situated on the east slope of Blind Springs Hill, 4 miles south of Benton, a station on the Southern Pacific Railroad. Elevation 5000 feet. Owner, *Benton Mining and Development Company,* of Los Angeles.

Two veins occur in hornblende granite, strike N. 10° W., and dip 40° to 45° east.

Development consists of a crosscut tunnel driven west 600 feet to develop the two veins that were worked in the early eighties. However, operations were suspended in 1924, without intersecting these veins. Idle.

Silverado Mine. (Silver.) This property comprises 15 claims known as the Silverado and Kentuck Group of Claims, situated in the Patterson Mining District, in Sec. 19, T. 7 N., R. 25 E., M. D. B. and M., 5 miles west of Sweetwater, Nevada. The mine is located on the eastern slope of Mount Patterson. Elevation 8600 feet. Owner, *Mono Mines Company,* of Nevada. Charles Gleixmer, president. Offices, 3123 North Clark street, Chicago, Illinois. Forest Mathoz, of Denver, consulting engineer; D. C. McKay, superintendent.

The Silverado Vein strikes N. 20° E., and dips 45° west, and has an average width of 4 feet. The footwall of the vein is andesite and the hanging wall is a rhyolitic porphyry. The vein material consists principally of quartz and shattered porphyry. The ore minerals found in the vein are pyrite, argentite, kerargyrite, associated with magnetite and other iron oxides. The silver minerals are intimately mingled with quartz and the richest ore has a dark, bluish color. The high grade ore occurs in the vein in lenticular masses. As a rule the high grade lenses of ore occur along the footwall of the vein. These rich lenses or masses are separated from one another at greater or less intervals by low grade ore, but the vein quartz in these intervals is never wholly barren. These rich masses occur where a series of parallel N. 55° W. faults cut the vein, but these faults do not displace the vein to any extent.

The mine is developed by four levels on the vein, known as the 500, 600, 700 and 800-foot levels that are 100 feet apart. The haulage tunnel is on the 600-foot level, which consists of a crosscut driven west 900 feet to the vein, with a drift south on the vein 1500 feet. The first ore shoot was encountered 350 feet south of this crosscut. The ore shoot worked was from 600 to 800 feet in length, with an average width of 4 feet and in places was worked for a width of 6 feet. A winze has been sunk from this level on the vein to a depth of 200 feet. At 100 feet below the collar of this winze, on the 500-foot level, the vein has been drifted on 700 feet. On the 700-foot level, which is 100 feet above the 600-foot level, the vein has been drifted on 1000 feet and the ore shoot developed on this level is 600 feet in length. On the 800-foot level the vein has been drifted on 600 feet.

All present development and stoping operations are confined to the levels above the 500-foot level. The high grade masses are being mined and sorted underground for shipment. The second grade ore is being stored in stopes for treatment in the mill. This latter ore is stated to have an average value of $10 per ton in silver. The high grade ore being shipped is said to carry from $200 to $600 per ton. This ore is now being shipped in ten-ton lots to the Humboldt smelter.

The Kentuck Mine, which is said to be on the same vein as the Silverado Mine, is 4480 feet south of the Silverado Mine workings, and 1400 feet in elevation above the 600-foot level.

The Kentuck Mine was opened up by two adit levels on the vein to a depth of 300 feet below the outcrop, and a winze from the lower tunnel level explored the vein to a depth of 100 feet. This property has not been worked since 1884 and its production is reported to be about $500,000.

Equipment: Electric power is secured from the company's hydro-electric power plant located on Green Creek, 9 miles south of Bridge-

port. The transmission line from power plant to mine is 32 miles in length. Air for mining operations is furnished by a Nordberg compressor, the compressor plant being located above the mill. There is also a 500-cu. ft. Sullivan compressor driven by 100-h.p. motor at the mine. Ore from mine is transported to crushing plant a distance of 1500 feet. The crushed ore is transported over an aerial bucket tram line 2500 feet in length to a 100-ton cyanide plant. The mill was idle at the time the property was visited, but the company plans to place the mill under operation by the first of October. Twenty men are employed.

Bibl: State Mineralogist's Reports VIII, pp. 359–361; XV, pp. 165–166. Report of Director U. S. Mint, 1883.

Silver Reef Mine. (Lead-Silver.) It comprises a group of 4 claims, situated on the east slope of the Benton Mountains and 11 miles southwest of Benton. Owner, Joe Main, of Benton, California. Elevation 5900 feet.

Two parallel veins occur in limestone that strike N. 20° W., and dip 60° west. Width of veins varies from 12 inches to 4 feet. The belt of limestone in which these veins occur is about one mile in width. In the vicinity of the veins there is a diorite intrusion that strikes N. 40° W.

Developments consist of 8 shafts sunk on the most easterly vein to depths of 50 to 200 feet. These shafts are about 100 feet apart, and all have produced some ore. Shipments of ore made from the property are reported to carry from $60 to $200 per ton in lead and silver.

The minerals contained in the vein quartz are argentite, with bromides and chlorides of silver, galena and cerussite. The Silver Reef Shaft is 125 feet deep sunk on the vein, with drifts south on the fissure at 90 and 125 feet. About 100 feet south of this shaft, there is a shaft 90 feet deep which is connected on the 90-foot level. To the south of the Silver Reef shaft, a distance of approximately 325 feet, there is another shaft on the vein to a depth of 300 feet. One man is employed.

Tower Mine. It comprises two patented claims, situated in the Indian Mining District, 8 miles southwest of Benton, on the west slope of the Benton Range of mountains. Elevation 6400 feet. Owner, W. W. Watterson, Bishop, California.

The vein occurs in granite and strikes N. 10° E., and dips 80° west. The width varies from 2 to 4 feet. The ore occurs in the vein as irregular bunches or kidneys of rich argentiferous pyrite in quartz, the associated minerals being chiefly sphalerite, pyrite, galena, with pyrargyrite and other antimonial silver ores.

Development consists of two shafts, one sunk on the vein to a depth of 200 feet, and about 300 feet west a vertical shaft sunk in the footwall granite to a depth of 300 feet. The mine is reported to have had a production of $150,000. Idle.

Wild Rose Mine. (Lead-Gold-Silver.) The property comprises five claims, situated in Wildrose Canyon, in the Chidago Mining District, 6 miles southwest of Benton, California. Elevation 7500 feet. Owner, C. W. Stone, Florida; W. N. Davis, agent, Benton. Under lease to John Zakeila and associates, of Benton.

The Wild Rose Vein occurs in granite and strikes north with a dip of 70° to the west. The vein has a width of 4 feet. The vein quartz is

mineralized with pyrite, galena, marcasite and carries values in gold and silver. The silver minerals contained are argentite and pyrargyrite.

Development consists of a crosscut tunnel driven east 200 feet to the vein, with drifts north and south on the vein. It is reported that the vein was drifted on a distance of 500 feet on this level. The vein has been stoped to the surface. At 30 feet north of the crosscut, a winze is being sunk on the vein. The property has a rated production of $100,000. Two men are employed.

NONMETALLIC MINERALS.

Mono County has a great variety of commercial minerals and contains deposits of both industrial and structural materials, whose development at present is held back by lack of transportation. The highly mineralized belt which runs through the county contains deposits of andalusite, barytes, clay, limestone, mineral water, pumice, salt, soda, silica, travertine and tuff.

ANDALUSITE.

Sillimanite and andalusite are both aluminum silicates (Al_2SiO_5) having the same composition and formula, but with slightly different physical characteristics. Though both crystallize in the orthorhombic system, their crystal habits are different, andalusite being usually in coarse, prismatic forms, the prisms nearly square in shape; also occurs massive, imperfectly columnar, and sometimes radiated and granular. Sillimanite commonly occurs in long, slender crystals, not distinctly terminated; prismatic faces, striated and rounded; often in close parallel groups, passing into fibrous and columnar massive forms, sometimes radiating. Colors are similar. Hardness, andalusite 7.5; sillimanite 6.7. Andalusite is slightly lighter in specific gravity.

Mono County has the distinction of having the only commercial deposit of andalusite so far discovered in the United States. A massive deposit of andalusite occurs in the White Mountains of the Inyo Range, and is being mined by the Champion Porcelain Company, of Detroit, Michigan.

Champion Porcelain Company's Andalusite Deposit. The deposit is located on the north side of Dry Creek Canyon, on the northwest slope of White Mountains, 7 miles east of Hammil, a station on the California and Nevada Railroad. Elevation 8600 to 10,000 feet. Holdings comprise four claims. Owner, Champion Porcelain Company, Detroit, Michigan. Dr. J. A. Jeffrey, president; B. A. Jeffrey, secretary; C. E. Julian, superintendent.

The country rock in the vicinity of the deposit consists of slates, schist, and quartzite. There are two prominent dikes, more or less parallel, which have a general northerly strike. The lower or most westerly dike is about 200 feet in width. This dike carries andalusite but it is too low grade to mine. The easterly dike, which occurs on the contact of diorite and granite, at a higher elevation, carries a higher content of andalusite. This dike is over 200 feet wide and forms a bold outcrop for a distance of over 500 feet. The andalusite occurs along the east face of this quartz or quartzite dike. The andalusite occurs as irregular stringers and lenses in the dike. The ore mined carries 75% andalusite.

The other minerals contained are pyrophyllite, muscovite, lazurite, corundum, rulite and lazulite.

Mining operations were started on this deposit in 1921, and it has been a steady producer to date.

Development consists of a tunnel driven west nearly through the dike, with laterals driven north and south along ore showings in the dike.

The ore is mined by open stope and pillar method. The ore is broken and sorted to a size of 4 to 6 inches in diameter. It is sacked to 100 pounds for packing by pack train to loading camp, a distance of 4 miles, then hauled by truck to Shealy Siding on the railroad for shipment to Detroit, Michigan, where it is utilized in the manufacture of porcelain for automobile spark plugs and for other high-tension electric insulators. The production amounts to about 150 tons per month.

Equipment consists of a compressor; air drills; and houses for employes. Fifteen men are employed.

Bibl: State Mineralogist's Report XX, pp. 149–154; Bull. 94, pp. 106–108.

Taylor Andalusite Deposit. It comprises six claims located north of the Champion Porcelain Company's property. Elevation 10,000 feet. Owner, A. Taylor, Benton, California.

The deposit occurs along the same dike that is being worked by the Champion Porcelain Company. Andalusite occurs as irregular stringers and lenses in the dike.

Development consists of a number of shallow opencuts and short tunnels. Idle.

LIMESTONE.

In the southeastern end of the county there is a belt of Cambrian limestone that occurs on the west slope of the White Mountains. This belt of limestone runs in a northerly direction from the Inyo County line to the Nevada state line. The belt is 25 miles in length and about 3 to 6 miles wide.

MINERAL SPRINGS.

There are a number of mineral springs in Mono County, the different hot springs in the northern and eastern portion being of considerable geologic interest. Some of these springs would become popular resorts were they accessible to a larger population.

Artesian Springs are located at Oasis, 30 miles northeast of Alvord, a station on the California and Nevada Railroad. Elevation 5100 feet. Water used for irrigation. Owner, J. H. Forman, of Oasis, California.

Banner Spring. It is situated west of Benton, in the Inyo National Forest. Elevation 7300 feet. Water used for watering sheep.

Benton Hot Spring. It is situated 300 yards northwest of Benton post office. Elevation 5640 feet. Owner, W. H. Davis, of Benton, California.

The spring is approximately 10 feet in diameter, in which the water has a temperature of 135° F. It has furnished a supply of water for the town for domestic and irrigation uses since 1862. Its discharge is approximately 400 gallons per minute. Quoting from a laboratory report made of the water by Smith-Emery Company, of Los Angeles:

"The water is unique because of the absence of lime and magnesium salts, as well as an exceptionally low content of other mineral constituents. Medical authorities state that water free from lime and magnesium salts is beneficial in the treatment of certain diseases, such as gall stones, kidney stones and diabetes."

Bibl: U. S. G. S. Water Supply Paper 338, p. 136.

Bertrand Ranch Springs are situated 6 miles east of north from Benton. Elevation 5000 feet. Temperature of water 70° F. Flow 100 gals. per minute. Used for irrigation.

Black Lake Springs are situated 2 miles northwest of Benton. Elevation 6425 feet. Used for irrigation. Owner, Peter Gilholt, of Benton, California.

Buckeye Hot Spring is situated about 5½ miles southwest of Bridgeport, on the north bank of Buckeye Creek. Elevation 6950 feet. The water issues with a temperature of 140° F., and flows at about 25 gallons per minute. The water contains notable amounts of lime and a high amount of iron in solution. Used for bathing.

Bibl: U. S. G. S. Water Supply Paper 338, pp. 132–133.

Casa Diablo Hot Springs are situated on lava slopes bordering Hot Creek, north of the main highway about 45 miles northwest of Bishop. Elevation 7350 feet.

In a small depression north of the highway, small amounts of vapor rise from a half dozen small pits. On the north rim of the depression, a small pit in the bank forms a 'paint pot' in which pink mud is kept in motion by bubbles of steam. Temperatures range from 115° to 198° F.

Bibl: U. S. G. S. Water Supply Paper 338, pp. 146–147.

Fales Hot Springs are situated 13 miles northwest of Bridgeport, on the road to Minden, Nevada. Elevation 7300 feet. Owner, Samuel Fales.

The hot water rises along the bed of a small creek which has been dammed to form a bathing pool. The temperature of the water issuing from the springs ranges from 129 to 141° F. It is reported to flow about 300 gallons per minute. Resort with hotel accommodations and cabins for camping parties.

Bibl: U. S. G. S. Water Supply Paper 338, p. 132.

Mono Basin Warm Springs are situated at the east edge of Mono Lake. Elevation 6425 feet.

Bibl: U. S. G. S. Water Supply Paper 338, pp. 145–146.

Moran Spring is situated 13 miles southwest of Benton. Elevation 7000 feet.

River Springs are situated 10 miles northwest of Benton. Elevation 6480 feet. Owner, A. Matlick, of Bishop. Water used for irrigation.

Travertine Springs. This group of springs is situated 1½ miles southeast of Bridgeport, on the hilly slopes of andesite lava, 200 to 300 feet above the valley. Here are located a number of prominent ridges

of banded onyx marble, 5 to 15 feet high and somewhat greater thickness. At two points near these ridges, small springs with temperature of 121 to 148° F. rise in pools about 3 to 10 feet in diameter. A third spring issues from a longitudinal crevice in the top of one of the ridges. Temperature is stated to be 148° F.

Bibl: U. S. G. S. Water Supply Paper 338, pp. 133–135.

Warner Hot Springs are situated one mile northeast of Casa Diablo Hot Springs and one-half mile northwest of the highway, 45 miles northwest of Bishop. Holdings comprise 6 claims, known as the Sulphate Group. Owner, P. A. Warner, Los Angeles. Elevation 7200 feet.

Two shafts were sunk to a depth of 10 feet. In the bottom of the shafts are vapor vents and some hot water. A number of hot springs are scattered over several acres of ground.

Whitmore Tub Springs are situated in Long Valley, 3 miles west of Owens River and about 7 miles southeast of Casa Diablo Springs. There are two oblong pools a few feet apart and 40 feet long in which warm water rises from which it flows to a shallow pond called Whitmore Tub. A new bathhouse has been built and the pools converted into a swimming tank.

Bibl: U. S. G. S. Water Supply Paper 338, pp. 147–148.

PUMICE AND VOLCANIC ASH.

There are extensive deposits of pumice that occur in the volcanic tableland on the west side of Hammil and Benton valleys. The principal deposits of this material extend from Benton south to the Inyo County line. Other deposits of importance occur on the west slope of the White Mountains, extending south from Sacramento Canyon to the Inyo County line. The material from Mono County is the volcanic ash or tuff variety and is employed in making soap and cleanser compounds.

California Quarries Pumice Deposit. It is situated 6 miles north of Laws on the west side of Hammil Valley. Holdings comprise 640 acres. Elevation 4400 feet. Owner, California Quarries Company, A. B. Rudock, president; Garnet C. Rainey, secretary; J. L. Hassett, superintendent. Offices, 1300 Quinby Bldg., Los Angeles.

The horizontal bed of white pumice is from 12 to 15 feet thick, with an overburden of red tuff from 25 to 75 feet in thickness.

Two quarries have been opened up on this bed of pumice. The method of working consists in stripping the overburden, then the pumice is transported by scrapers to an ore pocket above the mill. The material is white in color, and breaks up very fine. The lumps range from the size of a pea to that of a walnut. Material from the quarries goes to a 50-ton grinding and separating plant. The products produced are silica (crystal sand and pumice).

The material is used in making soap and cleanser compounds, also for stucco work, white cement and in acoustic plaster. Fifteen men are employed.

Blind Springs Hill Pumice Deposits. These deposits are situated on the east slope of Blind Springs Hill about 5½ miles south of Benton, a

station on the Southern Pacific Railroad. Elevation 5200 feet. Holdings comprise 16 claims. Owners, William Ray, Joe Moletesta, of Hawthorne, Nevada.

The occurrence on the east slope of Blind Springs Hill is one mile in length and about one-quarter of a mile in width. The bed of pumice is 20 feet thick, being overlain by red tuff from 5 to 25 feet thick. A number of tunnels and opencuts expose the bed of pumice for a distance of 1000 feet. The pumice is white in color and the sizes of the material range from pea size up to walnut size. Idle.

Sacramento Canyon Pumice Deposit. It comprises 40 acres situated on the west slope of the White Mountains north of Sacramento Canyon, 3 miles northeast of Chalfant, a siding on the Southern Pacific Railroad, and 11 miles north of Laws. Elevation 5300 feet. Owner, Joseph B Smith, of Laws, California.



California Quarries Company's Pumice Deposit, Mono County.

The bed of pumice is exposed on the surface for a distance of 500 feet in length, and about 200 feet in width. The pumice is pure white in color and most of the material is quite fine, the largest size being about the size of a walnut. Idle.

Yellow Jacket Canyon Pumice Deposits. In the low, rounded hills on both sides of Yellow Jacket Canyon, to the south of Yellow Jacket Spring, are exposed extensive deposits of white pumice. The beds exposed in the canyon are from 30 to 50 feet thick, with practically no overburden.

These deposits are situated 7 miles south of Benton, and 3½ miles west of Hammil, a station on the Southern Pacific Railroad. Elevation 5600 feet. Holdings comprise 640 acres, located in Sec. 8, T. 3 S., R. 3 E., M. D. B. and M. Owner, Joseph B. Smith, of Laws, California.

The pumice is pure white to gray in color. The material is quite fine, the largest size being about the size of a walnut. Idle.

SODA AND SALT.

The only soda produced in Mono County is derived from the waters of Lake Mono. The waters of this lake contain common salt, soda, borax and other soluble salts. The only production is a small amount of valuable medicinal salts obtained by evaporation of the water.

Lake Mono Salt Works. This plant is situated on the northeast shore of Lake Mono. Owner, Wallace D. McPherson, Mono Inn, Mono Lake postoffice.

The capacity of the plant is 250 pounds per 24 hours. The water from the lake is evaporated for the recovery of the salts which are sold for medicinal salts.

TRAVERTINE.

Bridgeport Travertine Deposits. These deposits are situated one mile southeast of the town of Bridgeport, on hilly slopes of andesite lava,



Travertine deposit, Bridgeport, Mono County.

200 to 300 feet above the valley. Owners, Chas. L. Hayes, of Bridgeport and Edward Dinneen, of Oakland, California. Holdings comprise 60 acres, which cover both springs and travertine deposits.

There are five prominent ridges of banded onyx marble, or travertine, from 6 to 15 feet high and of somewhat greater thickness that tend to radiate from a central point. These ridges are cut longitudinally by a vertical crevice. The travertine is banded and stained various shades of red and yellow. The material has a pleasing mottled effect, is sufficiently translucent to give depth to the coloring and takes a good polish. The deposit is 50 miles from the nearest railroad point.

Several quarries have been opened up on the deposit and a carload of the material shipped to the *Dinneen Marble Company*, of Oakland, in 1926.

Equipment consists of a derrick.

Bibl: State Mineralogist's Report XII, p. 640; XV, pp. 173, 174. U. S. G. S. Water Supply Paper 338, pp. 132–136.



Travertine being deposited by mineral spring at Bridgeport, Mono County. Photo by Walter W. Bradley.

TUFF.

Extensive deposits of tuff suitable for building material occur in the volcanic tableland that extends from the Inyo County line to Benton Hot Springs. South of the Mono County line in Round Valley, Inyo County, this material is being quarried by the Bly Stone Company, of Los Angeles.

The material in Mono County is being used locally by the ranchers in Hammil and Benton valleys in the construction of residences.

When quarried the material can be taken out in large blocks and can be sawed into dimensions required for buildings.

OIL FIELD DEVELOPMENT OPERATIONS.

By R. D. Bush, State Oil and Gas Supervisor.

From July 3, 1927, to and including October 1, 1927, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
COLUSA COUNTY:					
The Numa Oil Co.	19	15	5	1	
FRESNO COUNTY:					
Premier Oil Co.	24	20	14	24	Coalinga
Standard Oil Co.	7	20	15	227	Coalinga
Superior Oil Co.	26	21	17	Hanson 1	
Superior Oil Co.	16	17	14	Lillis-Welch 1	
KERN COUNTY:					
Associated Oil Co.	23	28	27	1	Kern River
Associated Oil Co.	23	28	27	5	Kern River
Associated Oil Co.	23	28	27	25	Kern River
Associated Oil Co.	23	28	27	35	Kern River
Associated Oil Co.	23	28	27	45	Kern River
Associated Oil Co.	23	28	27	55	Kern River
Associated Oil Co.	23	28	27	56	Kern River
California Petroleum Corp.	23	28	27	Lehmann 1	Kern River
C. C. M. O. Co.	23	28	27	7	Kern River
C. C. M. O. Co.	23	28	27	8	Kern River
C. C. M. O. Co.	23	28	27	9	Kern River
General Petroleum Corp.	14	28	27	14	Kern River
General Petroleum Corp.	14	28	27	15	Kern River
General Petroleum Corp.	14	28	27	28	Kern River
General Petroleum Corp.	26	28	27	Sill 2	Kern River
General Petroleum Corp.	26	28	27	Sill 13	Kern River
General Petroleum Corp.	14	28	27	Wetmore 13	Kern River
George F. Getty	14	28	27	Lehnhardt 17	Kern River
George F. Getty	14	28	27	Lehnhardt 18	Kern River
George F. Getty	14	28	27	Lehnhardt 19	Kern River
George F. Getty	14	28	27	Lehnhardt 23	Kern River
George F. Getty	14	28	27	Lehnhardt 24	Kern River
George F. Getty	14	28	27	Lehnhardt 25	Kern River
George F. Getty, Inc.	26	28	27	Grady 1	Kern River
George F. Getty, Inc.	22	28	27	Tegeler 23	Kern River
George F. Getty, Inc.	22	28	27	Tegeler 24	Kern River
George F. Getty, Inc.	22	28	27	Tegeler 25	Kern River
F. C. Grimes and Associates	14	28	28	Dorwart 1	Kern River
F. C. Grimes and Associates	14	28	28	Guerrier 1	Kern River
F. C. Grimes and Associates	14	28	28	Hartshorn 1	Kern River
Petroleum Securities Co.	22	28	27	5	Kern River
Petroleum Securities Co.	22	28	27	1-B	Kern River
The St. Helens Petroleum Co., Ltd.	26	28	27	1	Kern River
The St. Helens Petroleum Co., Ltd.	13	28	28	Kerneo 1	Kern River
Standard Oil Co.	27	28	27	10	Kern River
Standard Oil Co.	15	28	27	11	Kern River
Standard Oil Co.	27	28	27	11	Kern River
Standard Oil Co.	15	28	27	12	Kern River
Standard Oil Co.	27	28	27	12	Kern River
Standard Oil Co.	15	28	27	13	Kern River
Standard Oil Co.	15	28	27	14	Kern River
Standard Oil Co.	15	28	27	15	Kern River
Standard Oil Co.	15	28	27	16	Kern River
Standard Oil Co.	34	28	27	Emma Kramer 1	Kern River
Wonder Co., Ltd.	23	28	27	12	Kern River
Wonder Co., Ltd.	23	28	27	13	Kern River
Cymric Oil Co.	26	29	21	5	McKittrick
Keefe-Morrison, Inc.	8	30	22	6	McKittrick
Keefe-Morrison, Inc.	8	30	22	6-A	McKittrick
North American Oil Cons.	32	31	24	12	Midway
North American Oil Cons.	30	31	24	44	Midway
Standard Oil Co.	29	31	24	44	Midway
Standard Oil Co.	7	32	24	235	Midway

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued.					
Victor Oil Co	35	32	23	7-A	Midway
Midland Oilfields Co., Ltd	6	27	28	D. G. Vedder 1	Mt. Poso
Shell Co	1	27	27	Glide 2	Mt. Poso
Superior Oil Co	13	27	28	Glide 1	Mt. Poso
Union Oil Co	10	11	23	Houchin 3	Sunset
J. F. Harrison & Co	36	29	20	2	Temblor
J. F. Harrison & Co	36	29	20	3	Temblor
Standard Oil Co	27	11	20	Kern Co. Lease 2 30	Wheeler Ridge
General Petroleum Corp	5	30	29	Kerwin 1	
George F. Getty, Inc	22	29	29	Bill Beaizley 1	
L. & B. Producing & Drilling Co	19	28	29	Jewett 1	
Ed. McAdams, Trustee	26	29	23	G. & Y. 1	
North American Oil Cons	5	25	26	Wallace 1	
The Pacific Eastern Production Co	21	29	27	Fruitvale 1	
Shell Co	3	28	28	Glide 1	
KINGS COUNTY:					
General Petroleum Corp	4	24	19	Kettleman 1	
LOS ANGELES COUNTY:					
Union Oil Co	33	3	13	Callender 20	Dominguez
Brownmoor Oil Co	7	2	14	7	Inglewood
Standard Oil Co	17	2	14	Baldwin-Cienega 45	Inglewood
Standard Oil Co	17	2	14	Baldwin-Cienega 53	Inglewood
Standard Oil Co	17	2	14	Baldwin-Cienega 54	Inglewood
Standard Oil Co	17	2	14	L. A. Invest. 1 54	Inglewood
Acme Petroleum Corp	19	4	12	Damron 7	Long Beach
Delaney Petroleum Corp	29	4	12	14	Long Beach
Graham-Loftus Oil Co	19	4	12	Butler 1	Long Beach
George W. Johnson	29	4	12	Crest 3	Long Beach
A. S. Johnston Drilling Co	29	4	12	1	Long Beach
McKeon Drilling Co., Inc	19	4	12	Evans 1	Long Beach
J. E. O'Donnell	19	4	12	59	Long Beach
Pan-American Petroleum Co	19	4	12	Chaney 3	Long Beach
The Petroleum Co	24	4	13	Nutting-Lough 2	Long Beach
Richfield Oil Co	19	4	12	Bernstein 2-A	Long Beach
Richfield Oil Co	29	4	12	Freeman 2	Long Beach
Richfield Oil Co	19	4	12	Hass 14	Long Beach
Richfield Oil Co	19	4	12	Kelly 1	Long Beach
San Martinez Oil Co	29	4	12	Booth Comm. 8	Long Beach
Shell Co	29	4	12	Alamitos 24	Long Beach
Stevens Drilling Co	24	4	13	Steve 2	Long Beach
Standard Oil Co	6	2	11	Baldwin 71	Montebello
McCoy & Anderson	13	3	16	4	Newhall
Fred E. Cole	18	3	13	2	Rosecrans
Shell Co	6	3	11	Slusher 12	Santa Fe Springs
Standard Oil Co	5	3	11	So. Whittier Comm. 20	Santa Fe Springs
Associated Oil Co	11	5	12	Hellman 17-A	Seal Beach
Associated Oil Co	11	5	12	Hellman 27	Seal Beach
General Petroleum Corp	3	5	12	Wasem 6-A	Seal Beach
Marland Oil Co	11	5	12	McGrath & Selover 20	Seal Beach
Olympic Refining Co	3	5	12	12	Seal Beach
Standard Oil Co	3	5	12	San Gabriel 14-A	Seal Beach
C. C. M. O. Co	17	4	14	Del Amo 95	Torrance
C. C. M. O. Co	8	4	14	Del Amo 96	Torrance
C. C. M. O. Co	15	4	14	Torrance 71	Torrance
C. C. M. O. Co	15	4	14	Torrance 79	Torrance
Anchor Petroleum Co	19	2	10	1	
John B. Harding	28	7	11	La Loma 1	
Monterey Park Petroleum Co	26	1	12	Browning 1	
J. E. O'Donnell	29	3	14	61	
San Clemente Oil Co	20	3	14	1	
White Bear Consolidated Oil Co	20	4	13	Watson 1	

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
MADERA COUNTY:					
Fort Wayne-Madera Syn.	22	10	17	1	
ORANGE COUNTY:					
Shell Co.	1	3	10	Fisher 7	Brea-Olinda
Shell Co.	2	3	10	Orange 14	Brea-Olinda
Shell Co.	2	3	10	Orange 16	Brea-Olinda
Chiksan Oil Co.	19	3	9	Mathis 2	Coyote Hills
Herndon Petroleum Corp.	19	3	9	Lemke 3	Coyote Hills
Herndon Petroleum Corp.	20	3	9	Queyrel 1	Coyote Hills
Petroleum Securities Co.	19	3	9	Wright 1	Coyote Hills
Union Oil Co.	33	3	13	Callender 21	Dominguez
B. H. R. Oil Co.	10	6	11	DuBois 1	Huntington Beach
Bell of Montebello Oil Co.	2	6	11	5-A	Huntington Beach
J. A. Brower	11	6	11	1	Huntington Beach
Allen Brown	10	6	11	Allen Brown 3	Huntington Beach
George E. Cloud	10	6	11	1	Huntington Beach
Harry B. Custer	34	5	11	2	Huntington Beach
Davis, Haines & Tompkins	10	6	11	1	Huntington Beach
Davis, Quine & Davis	10	6	11	1	Huntington Beach
J. F. Garliepp	10	6	11	Andrews 1	Huntington Beach
Globe Lease & Royalty Co.	27	5	11	3	Huntington Beach
Golden Rod Oil Co.	2	6	11	Golden Rod 3	Huntington Beach
H. & M. Oil Well	10	6	11	1	Huntington Beach
Hauser Petroleum Co.	10	6	11	1	Huntington Beach
James & Price	10	6	11	2	Huntington Beach
James & Price	10	6	11	3	Huntington Beach
S. W. Lea and L. E. Kesselman	10	6	11	H. B. 1	Huntington Beach
Lloyd & Reynolds	10	6	11	1	Huntington Beach
Loftin Oil Co.	10	6	11	2	Huntington Beach
C. B. Lones	10	6	11	1	Huntington Beach
Ben F. Mun	10	6	11	Mun 1	Huntington Beach
Ben F. Mun	10	6	11	Mun 2	Huntington Beach
J. E. O'Donnell	27	5	11	O'Donnell 60	Huntington Beach
Standard Oil Co.	4	6	11	Bolsa 31	Huntington Beach
Standard Oil Co.	10	6	11	P. E. 14	Huntington Beach
Standard Oil Co.	10	6	11	P. E. 15	Huntington Beach
Leo Stein	21	5	11	1	Huntington Beach
Frank Vessels	10	6	11	1	Huntington Beach
Warren and Macrate	10	6	11	2	Huntington Beach
Warren and Macrate	10	6	11	3	Huntington Beach
Sy Wicker	10	6	11	2	Huntington Beach
World Petroleum Corp.	10	6	11	7	Huntington Beach
World Petroleum Corp.	10	6	11	8	Huntington Beach
Young-Lundberg	10	6	11	Y. L. 1	Huntington Beach
Associated Oil Co.	33	3	9	Kammerer 8	Richfield
California Petroleum Corp.	32	3	9	Bradford 7	Richfield
California Petroleum Corp.	33	3	9	Heartwell 3	Richfield
Continental Oil Co.	33	3	9	Pyne 6	Richfield
General Petroleum Corp.	33	3	9	Atwood 1	Richfield
Petroleum Securities Co.	25	3	9	Kramer 1	Richfield
Standard Oil Co.	34	3	9	Anaheim Union 3	Richfield
Standard Oil Co.	34	3	9	Moll. Comm. 2	Richfield
Standard Oil Co.	34	3	9	Yorba 1	Richfield
Superior Oil Co.	33	3	9	Etchandy 2	Richfield
Union Oil Co.	33	3	9	Stern 11	Richfield
Union Oil Co.	28	3	9	Towell 5	Richfield
Union Oil Co.	34	3	9	Yorba Linda Group 15	Richfield
Union Oil Co.	34	3	9	Yorba Linda Group 16	Richfield
Chas. A. Son, Trustee	5	5	11	Orangeana 1	
SAN MATEO COUNTY:					
Sequoia Oil & Gas Co.	13	7	5	Souza 1	
SANTA BARBARA COUNTY:					
Palmer Union Oil Co.	30	9	32	Stendel 11	Cat Canyon
R. & G. Oil Co.	30	9	32	8	Cat Canyon
Miley Oil Co.	5	4	29	Dreyfus 1	Goleta

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
SANTA BARBARA COUNTY—Cont					
Miley Oil Co	4	4	29	Goleta 8	Goleta
Miley Oil Co	3	4	29	Goleta 9	Goleta
Santa Barbara Oil Co	3	4	29	Hollister 3-A	Goleta
Frank Buttram	*	6	31	Reuben 1	
Henry R. Dabney	1	4	27	Wright 1	
Jay J. Rekar	8	4	28	1	
San Marcus Oil Co	3	6	29	1	
SANTA CRUZ COUNTY:					
Frank Marik	18	11	2	2	
SONOMA COUNTY:					
Shell Co		5	6	Murphy 2	
VENTURA COUNTY:					
Marilon Oil Co	33	2	20	53	Conejo
Powell Petroleum Assn	33	2	20	2-P	Conejo
Trantas Oil Co	33	4	18	Eureka 1	Piru
Willis W. Bryant	21	4	21	1	Santa Paula
Group Syndicate	1	4	20	1	Sespe
Oak Ridge Oil Co	18	3	20	Willard 23	South Mountain
Ring Petroleum Corp	23	3	21	1	South Mountain
Union Oil Co	13	3	21	Snyder 3	South Mountain
Associated Oil Co	22	3	23	Hartman 20	Ventura
Associated Oil Co	27	3	23	Lloyd 39	Ventura
Associated Oil Co	27	3	23	Lloyd 46	Ventura
Associated Oil Co	23	3	23	Lloyd 102	Ventura
General Petroleum Corp	21	3	23	Hisey 2	Ventura
Petroleum Securities Co	28	3	23	Orton 4	Ventura
Petroleum Securities Co	28	3	23	Orton 5	Ventura
Petroleum Securities Co	28	3	23	Willett 3	Ventura
Shell Co	28	3	23	Edison 16	Ventura
Shell Co	21	3	23	Edison 19	Ventura
Shell Co	27	3	23	Gosnell 24	Ventura
Shell Co	28	3	23	Gosnell 25	Ventura
Shell Co	28	3	23	Taylor 22	Ventura
Shell Co	28	3	23	Taylor 24	Ventura
Scott Petroleum Properties, Inc	35	4	25	Rincon 1	

*Rancho San Carlos de Jonata.

SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff and others are published in each number of 'Mining in California.'

These special articles cover a wide range of subjects, both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

DEPARTMENT OF NATURAL RESOURCES ACT.

Chapter 128.

[Stats. 1927.]

An act to add a new article to chapter three of title one of part three of the Political Code, to be numbered article two j, embracing sections three hundred seventy-three to three hundred seventy-three i, relating to a department of natural resources.

[Approved by the Governor April 13, 1927.]

The people of the State of California do enact as follows:

SECTION 1. The Political Code is hereby amended by adding a new article to chapter III of title I of part III thereof, to be numbered article II*j*, embracing sections 373 to 373*i* and to read as follows:

ARTICLE II*j*.

DEPARTMENT OF NATURAL RESOURCES.

373. A department of the government of the State of California to be known as the department of natural resources is hereby created. The department shall be conducted under the control of an executive officer to be known as the director of natural resources, which office is hereby created. The director shall be appointed by and hold office at the pleasure of the governor and shall receive a salary of six thousand dollars per annum.

Except as in this article otherwise provided, the provisions of article II of this chapter, title, and part of the Political Code as adopted at the forty-fourth session of the Legislature and as the same may be amended from time to time shall govern and apply to the conduct of the department of natural resources in every respect the same as if such provisions were herein set forth at length and wherever in said article II the term "head of the department" or similar designation occurs, the same shall for the purposes of this article mean the director of natural resources.

373*a*. For purposes of administration the department shall be forthwith organized by the director thereof, subject to the approval of the governor, in such manner as he shall deem necessary to properly segregate and conduct the work of the department, and the director shall have power to appoint in accordance with the civil service and other provisions of law such deputies, officers and other expert and clerical assistants as may be necessary. The work of the department is hereby divided into at least four divisions to be known as the division of mines and mining, the division of forestry, the division of parks and the division of fish and game.

373*b*. The division of mines and mining shall be administered through a chief of division who shall also be known as the state mineralogist. He shall be appointed by the director of natural resources and shall receive a salary of six thousand dollars per annum.

373c. The division of forestry shall be administered through a chief of division who shall be known as the state forester, who shall be a technically trained forester, appointed by the director of natural resources upon nomination by the state board of forestry hereinafter provided. General policies for the guidance of the division of forestry shall be determined by a state board of forestry which shall consist of seven members appointed by and holding office at the pleasure of the governor. Of the seven members one shall be familiar with the pine timber industry, one with the redwood industry, one with the live stock industry, one with general agriculture and one with the problems of water conservation.

373d. The division of parks shall be administered through a chief of division who shall be appointed by the director of natural resources upon nomination by the state park commission hereinafter provided. General polices for the administration of the state park system shall be determined by the state park commission which is hereby created to consist of five members appointed by the governor and holding office at his pleasure.

373e. The division of fish and game shall be administered through a fish and game commission consisting of three members appointed by and holding office at the pleasure of the governor.

373f. The chiefs of the divisions of forestry and parks respectively shall receive such salaries as may be determined by the director with the approval of the governor. The director of natural resources and the chief of each division before entering upon his duties shall execute to the State of California an official bond in the penal sum of twenty-five thousand dollars conditioned upon the faithful performance of his duties. The members of the board of forestry, the state parks commission and fish and game commission shall serve without compensation, but shall be entitled to their actual expenses incurred in the performance of their duties.

373g. The department of natural resources shall succeed to and is hereby invested with all the duties, powers, purposes, responsibilities and jurisdiction of the state mining bureau, state mineralogist, department of petroleum and gas, state oil and gas supervisor, state forester, state board of forestry, California redwood park commission, San Pasqual battlefield commission, Mount Diablo park commission, state fish and game commission, state fish and game commissioners, and, except as herein otherwise provided, of the several officers, deputies and employees of such bodies and offices, and whenever by the provisions of any statute or law now in force or that may hereafter be enacted a duty or jurisdiction is imposed or authority conferred upon any of said officers, offices, bodies, deputies or employees by any statute the enforcement of which is transferred to the department, such duty, jurisdiction and authority are hereby imposed upon and transferred to the department of natural resources and the appropriate officers thereof with the same force and effect as though the title of said department of natural resources had been specifically set forth and named therein in lieu of the name of any such body, office, officer, deputy or employee. Said bodies and offices, the duties, powers, purposes, responsibilities and jurisdiction of which are so transferred and vested in the department of natural resources, and the positions of all officers, deputies and employees thereunder, are and each of them is hereby abolished and shall have no further legal existence, but the statutes and laws under which they existed and all laws prescribing their duties, powers, purposes, responsibilities and jurisdiction, together with all lawful rules and regulations established thereunder are hereby expressly continued in force.

The department of natural resources shall be in possession and control of all records, books, papers, offices, equipment, supplies, moneys, funds, appropriations, land and other property real or personal now or hereafter held for the benefit or use of said bodies, offices and officers.

The boards of district oil and gas commissioners, the offices of district oil and gas commissioners and the board of review, correction and equalization created by the act approved June 10, 1915, establishing the department of petroleum and gas, are hereby respectively continued in force with the powers, duties, responsibilities and jurisdiction in them vested by the provisions of said act approved June 10, 1915, as amended; *provided*, that said board of review shall consist of the director of natural resources, the director of finance and the chairman of the state board of equalization.

373h. The management and control of the property acquired by the State of California under or pursuant to the provisions of the act entitled "An act to accept the gift to the state of San Pasqual battlefield in San Diego county, to provide for collecting and systematizing the history of said battle, for determining the exact

location thereof, and to report a suitable method of marking said battlefield and commemorating the heroism of those Americans who fought and died there," approved May 11, 1919, is hereby transferred to and vested in the department of natural resources.

373*i*. From and after the date upon which this act takes effect, the department of natural resources shall be and is hereby authorized and empowered to expend the moneys in any appropriation or in any special fund in the state treasury now remaining or made available by law for the administration of the provisions of all the statutes the administration of which is committed to the department, or for the use, support, or maintenance of any board, bureau, commission, department, office or officer whose duties, powers, and functions are, by the provisions of this article, transferred to and conferred upon the department of natural resources. Such expenditures by the department shall be made in accordance with law in carrying out the purposes for which such appropriations were made or such special funds created.



ADMINISTRATIVE DIVISION.

WALTER W. BRADLEY, Deputy State Mineralogist.

Personnel.

There have been no changes of personnel to be noted during the past quarter.

Department of Natural Resources.

As one of the departments of the state government the director of which is a member of the Governor's Council, the Department of Natural Resources was created by act of the forty-seventh session of the legislature, and approved by the Governor April 13, 1927, becoming effective July 29, 1927. The work of the new department is divided at present into four divisions, comprising the Division of Mines and Mining, Division of Forestry, Division of Parks, Division of Fish and Game.

Under this statute, the State Mining Bureau created by the act of 1880 becomes the Division of Mines and Mining, of which the State Mineralogist continues as the titular head, subordinate to the Director of the Department of Natural Resources. The office of the Director is in Sacramento.

The text of the act of 1927 is given in the preceding pages.

New Publications.

During the quarterly period covered by this issue, the following Bureau publications have been made available for distribution:

Mining in California (quarterly), April, 1927, and July, 1927, being chapters 2 and 3, respectively, of State Mineralogist's Report XXIII. Price 25 cents each. Chapter 2 contains reports on the mineral resources of Amador and Solano counties; and Chapter 3, on Placer and Los Angeles counties.

Summary of Operations, California Oil Fields: Vol. 12, Nos. 9, 10, 11, March, April and May, 1927, respectively. These contain special articles on: 'Conservation of Gas in the Production of Oil,' 'Fossil Markers of Midway-Sunset-Elk Hills Region in Kern County, California,' and 'Development of the Maricopa Shale Production in the Southeastern Portion of Thirty-five Anticline, Sunset Oil Field, Kern County, California,' respectively.

Commercial Mineral Notes: Nos. 53, 54, 55, August-October (inc.). These 'notes' carry the list of 'mineral deposits wanted' and 'minerals for sale' issued in the form of a mimeographed sheet monthly. It is mailed free to those on the mailing list for 'Mining in California.'

Mails and Files.

The Division of Mines maintains, in addition to its correspondence files and the library, a mine file which includes original reports on the various mines and mineral properties of all kinds in California.

During the period covered by this quarterly report, there were 1415 letters received and answered at the San Francisco office alone, covering almost every phase of prospecting, mining, and developing mineral deposits, reduction problems, marketing of refined products, and mining law. In addition to this, hundreds of oral questions are answered daily, both at the main office and the branches, for the many inquirers who come in for personal interviews and to consult the files and library.

DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum, Laboratory.

WALTER W. BRADLEY, Deputy State Mineralogist.

STATISTICS.

Data on the 1926 production of some of California's minerals were given in both the April and July issues of MINING IN CALIFORNIA, and tabulations are presented herein showing the completed totals for all substances for that year grouped by substances and by counties. The complete, detailed annual report on the mineral production of California for 1926 is now available, as Bulletin No. 100 of the State Division of Mines and Mining.

Summary for 1926.

The total value of the mineral output of California for the year 1926 was $450,330,856, being an increase of $15,811,196 over the 1925 total of $434,519,660. There were fifty-six different mineral substances, exclusive of a segregation of the various stones grouped under gems; and all of the fifty-eight counties of the state contributed to the list.

As revealed by the data following, the salient features of 1926 compared with the preceding year were: The considerable increase in value of both the petroleum and natural gas yields; and material advances also made by miscellaneous stone, zinc, cement, soda, salt, and pottery clays. Decreases were registered by gold, copper, silver, brick, granite, magnesite. There were a number of other minor variations. The net result was an increase in the grand total for all groups of nearly sixteen million dollars, as stated above. Petroleum accounted for an increase of $14,936,848 in total value due to advanced prices, in spite of a drop from 232,492,147 barrels to 224,673,281 barrels in quantity, or a difference of 7,818,866 barrels.

Of the metals: Zinc increased from 11,546,602 pounds worth $877,542 to 20,447,559 pounds worth $1,533,568 due to heavy shipments of concentrates to Belgium; lead from 7,352,422 pounds and $639,661 to 8,067,873 pounds and $645,429. Copper decreased from 46,968,499 pounds valued at $6,669,527 to 33,521,544 pounds and $4,693,014; gold from $13,065,330 to $11,923,481; silver from 3,054,416 fine ounces worth $2,119,765 to 2,022,460 fine ounces and $1,262,015; quicksilver from 7683 flasks and $621,831 to 5892 flasks and $516,382, though the average price per flask received by the producers advanced from $80.81 for 1925 to $87.64 for the year 1926. Though the gold yield decreased a million dollars in value, California continues to account for approximately 30 per cent of the gold output of the United States.

Of the structural group: Miscellaneous stone advanced from $17,409,854 to $19,859,873 in value; cement from 13,206,630 barrels worth $25,043,335 to 13,797,173 barrels and $25,269,678, the average price per barrel dropping slightly. Granite dropped from a valuation of $1,853,859 to $655,332; brick and hollow building-blocks or tile from $7,503,976 to $7,026,124; magnesite from 64,623 tons, crude, valued at $872,944 to 50,915 tons and $587,642. Of the 'industrial' and 'salines' groups, as is usually the case, there were a number of fluctuations, the

most important increase being shown by pottery clays from 537,587 tons valued at $674,376 to 797,461 tons and $806,509.

By Substances.

The distribution of the 1926 output of California by substances is shown in the following tabulation:

Substance	*Amount*	*Value*
Barytes	4,978 tons	$38,165
Bituminous rock	3,863 tons	21,577
Borates	47,605 tons	1,625,298
Brick and hollow building tile		7,026,124
Cement	13,797,173 bbls.	25,269,678
Chromite	395 tons	7,063
Clay (pottery)	797,461 tons	806,509
Coal	1,100 tons	5,000
Copper	33,521,544 lbs.	4,693,014
Dolomite	68,640 tons	119,313
Feldspar	7,300 tons	56,400
Fuller's earth	23,552 tons	250,192
Gems		9,049
Gold		11,923,481
Granite		655,332
Gypsum	114,868 tons	211,337
Lead	8,067,873 lbs.	645,429
Lime	63,568 tons	670,837
Limestone	108,795 tons	367,501
Magnesite	50,915 tons	587,642
Magnesium salts	4,881 tons	124,470
Manganese ore	235 tons	4,700
Marble	34,806 cu. ft.	119,999
Mineral paint	569 tons	5,846
Mineral water	14,074,877 gals.	1,171,550
Natural gas	214,549,477 M cu. ft.	19,465,347
Onyx and travertine	15,090 cu. ft.	7,575
Petroleum	224,673,281 bbls.	345,546,677
Platinum	306 fine oz.	32,005
Potash	32,884 tons	812,285
Pumice and volcanic ash	7,170 tons	48,350
Pyrites	100,896 tons	466,088
Quicksilver	5,892 flasks	516,382
Salt	311,761 tons	1,124,978
Sandstone	34,100 cu. ft.	17,500
Silica (sand and quartz)	30,010 tons	104,317
Silver	2,022,460 fine oz.	1,262,015
Slate		7,371
Soapstone and talc	17,004 tons	255,645
Soda	63,333 tons	1,305,802
Stone, miscellaneous [a]		19,859,873
Tungsten concentrates	441 tons	316,560
Zinc	20,447,559 lbs.	1,533,568
Unapportioned [b]		1,233,012
Total value		$450,330,856

[a] Includes macadam, ballast, rubble, riprap, sand, gravel and grinding-mill pebbles.
[b] Includes antimony, asbestos, bromine, calcium chloride, diatomaceous earth, iron ore, lithia, shale oil, sillimanite-andalusite-cyanite group.

By Counties.

Distribution by counties is given in the following tabulation:

Alameda	$3,158,474	Placer	$480,882
Alpine	450	Plumas	3,572,628
Amador	2,451,500	Riverside	6,194,253
Butte	461,945	Sacramento	2,243,952
Calaveras	1,809,772	San Benito	2,400,850
Colusa	91,194	San Bernardino	14,218,475
Contra Costa	2,610,553	San Diego	1,241,324
Del Norte	70,464	San Francisco	112,193
El Dorado	302,086	San Joaquin	842,000
Fresno	6,699,928	San Luis Obispo	253,294
Glenn	58,391	San Mateo	1,893,853
Humboldt	706,670	Santa Barbara	2,583,548
Imperial	467,314	Santa Clara	1,028,506
Inyo	2,835,834	Santa Cruz	3,504,194
Kern	83,556,074	Shasta	2,886,144
Kings	720	Sierra	569,515
Lake	75,693	Siskiyou	494,151
Lassen	19,063	Solano	1,770,820
Los Angeles	194,358,926	Sonoma	222,586
Madera	425,738	Stanislaus	401,997
Marin	527,553	Sutter	397
Mariposa	319,724	Tehama	10,340
Mendocino	15,800	Trinity	611,797
Merced	192,665	Tulare	397,920
Modoc	37,991	Tuolumne	615,998
Mono	209,848	Ventura	30,208,369
Monterey	359,993	Yolo	20,560
Napa	341,571	Yuba	2,921,083
Nevada	3,240,211		
Orange	63,223,082	Total	$450,330,856

MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections in North America; and contains not only specimens of most of the known minerals found in California, but much valuable and interesting material from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well as by those who utilize the facilities of the collection.

The exhibit is daily visited by engineers, students, business men and prospectors as well as tourists and mere sightseers. Besides its practical use in the economic development of California's mineral resources, the collection is a most valuable educational asset to the state and to San Francisco.

LABORATORY.

FRANK SANBORN, Mineral Technologist.

A considerable number of samples of granitic rock, said to contain tin, have been received at this laboratory during the past year. These samples come from different localities in the state, from northern and southern California. Frequently a small amount of metal, said to have been reduced from the rock, is included in the sample. This metal usually proves to be an alloy of lead and tin, having a composition similar to that of tinfoil. It is generally claimed that the metal was obtained by simply crushing the rock and placing the ground material in a hot wood fire. The tin, being thus reduced, was later collected by panning the ashes.

In no case have we been able to detect any tin or lead in these samples of granitic rock. Undoubtedly, those who have submitted the samples were shown by someone how to treat the rock in order to reduce the metal. We do not know whether or not the wood used as fuel was secretly treated beforehand by the same instructor.

A total of 1117 samples were received and determined at the laboratory during the three-month period covered by this report. Many of these samples were of minerals having commercial possibilities, provided they were from deposits of sufficient size.



LIBRARY.

E. A. Lowe, Librarian.

In addition to the numerous standard works, authorative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the Division of Mines and Mining contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the State are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

OFFICIAL PUBLICATIONS RECEIVED.

Governmental.

U. S. Geological Survey:

Bulletin 792–C. The Toklet-Tonzona Region. By Stephen R. Capps. Investigations in Northern Alaska. By Philip S. Smith.

Bulletin 796–A. The Gillette Coal Field Northwest of Wyoming. By C. E. Gibbon and B. R. Barnett. With a chapter on the Minturn District and the northwestern part of the Gillette Field. By W. T. Thom, Jr.

Prof. Paper 149. Correlation of Geologic Formations between East-Central Colorado, Central Wyoming and Southern Montana. By Willis T. Lee.

Water Supply Paper 566. Surface Water Supply of the United States, 1923. Part 6—Missouri River Basin.

Water Supply Paper 570. Surface Water Supply of the United States, 1923. Part 10—The Great Basin.

Water Supply Paper 596–C. Ground Water in the Ordovician Rocks near Woodstock, Va. By Geo. M. Hall.

Water Supply Paper 596–D. Quality of Water of Pecos River in Texas. By W. D. Collins, and H. B. Riffenburg.

U. S. Bureau of Mines:

Technical Paper 415. The Function of Steam in Lime Kiln. By Ernest E. Berger.

Technical Paper No. 426. Production of Explosives in the United States during 1926, with Notes on Mine Accidents Due to Explosives. By Wm. W. Adams.

Mineral Resources of the United States. 1926. Preliminary Summary. Introduction by Frank H. Katz. Statistics assembled by Martha B. Clark.

Graphite in 1925.

Carbon Black Produced from Natural Gas in 1925.

Feldspar in 1925.

Asphalt and Related Bitumins in 1925.
Gold, Silver, Copper, Lead and Zinc in Montana in 1925.
Platinum and Allied Metals in 1926.
Selenium and Tellurium in 1926.
Gold, Silver, Copper, Lead and Zinc in Nevada in 1925.
Carbon Black Produced from Natural Gas in 1926.
Bauxite and Aluminum in 1926.
Fluorspar and Cryolite in 1926.
Mica in 1925.
Barite and Barium Products in 1926.
Selenium and Tellurium in 1926.
Gold, Silver, Copper and Zinc in the Eastern States in 1926.
Arsenic in 1926.
Salt, Bromide and Calcium Chloride in 1926.
Platinum and Allied Metals in 1926.
Tin in 1926.
Asphalt and Related Bitumens in 1926.
Antimony in 1926.
Bauxite and Aluminum in 1926.
Gold, Silver, Copper, Lead and Zinc in Colorado in 1926.

Reports of Investigations:

Serial No.:

2805—Known Accumulation of Gas Ignited by Unapproved Rock-Dusting Machine. By L. D. Tracy and C. W. Owings.
2806—The Interpretation of Crude Oil Analyses. By N. A. C. Smith.
2807—Properties of Typical Crude Oils From the Producing Fields of Venezuela. By A. J. Kraemer.
2808—Analyses of Spindletop, Texas, Crude Oils. By A. J. Kraemer and Peter Grandone.
2809—Coal Mine Fatalities in April, 1927. By W. W. Adams.
2810—Consumption of Explosives in April, 1927. By W. W. Adams.
2817—Desulphurizing Action of Manganese in Iron. By C. H. Herty, Jr., and J. M. Gaines, Jr.
2818—Permissible Explosives Approved Prior to June 30, 1927. By G. St. J. Perrott and S. P. Howell.
2819—Apparatus for Vacuum Distillation of Lubricating and Heavy Petroleum Oils. By Martin J. Gavin and Arch. L. Foster.
2820—The Wire Saw in Slate Quarrying. Preliminary Report. By Oliver Bowles.
2821—Coal Mine Fatalities in June, 1927. By W. W. Adams.
2822—The Use of Solvents for Dewaxing Paraffin Base Crude Oil. By H. M. Smith.
2823—Consumption of Explosives in June, 1927. By W. W. Adams.
2824—Analyses of Crude Oils From the Seminole District, Oklahoma. By A. J. Kraemer.
2825—Coal Mine Fatalities in July, 1927. By W. W. Adams.
2826—Consumption of Explosives in July, 1927. By W. W. Adams.
2827—Sixteenth Semi-Annual Motor Gasoline Survey. By E. C. Lane, D. J. Condit, and C. S. Luce.
2828—The Detection of Sulphur in Petroleum and Petroleum Distillates. By F. W. Lane and John M. Devine.
2829—Progress of Fuel Economy at Petroleum Refineries in the United States. By G. R. Hopkins.
2830—Coal Mine Fatalities in August, 1927. By W. W. Adams.
2831—Consumption of Explosives in August, 1927. By W. W. Adams.

Information Circulars:

Circular No. 6036—Questions and Answers on Bureau of Mines Approvals of Electrical Equipment.
Circular No. 6037—One Hundred and One Questions on Electrical Inspection In and About Mines.
Circular No. 6045—Coal Mine Safety Organization.
Circular No. 6046—Wanted: More Detailed Reports on Electrical Accidents. By L. C. Ilsley.
Circular No. 6047—List of Permissible Mining Equipment.

Circular No. 6048—Instructions for Sampling Atmospheric Dust by the Impinger Method. By Alden H. Emery.

U. S. Coast and Geodetic Survey: Progress of Seismological Investigations in the United States, January 1, 1925, to June 30, 1927. By N. H. Heck.

U. S. National Museum: Proceedings, Vol. 72—Heretofore Undescribed Meteoric Irons from

1. Bolivia, South America.
2. West Arkansas.
3. Seneca Township, Michigan.

By Geo. P. Merrill.

Vol. 1—The Recently Found Iron Meteorite from Oakley, Idaho. By Geo. P. Merrill.

California Academy of Science: Proceedings, 4th Series, Vol. 14, No. 19: Paleontology of the Miocene of Lower California. By Leo Geo. Hertlein and Harry Knight Jordan.

Connecticut State Geological and Natural History Survey: Bulletin 39—Guide to the Insects of Connecticut. Part V. The Odonata or Dragon Flies of Connecticut. By Philip Garman.

Idaho Bureau of Mines and Geology:

Pamphlet 18. Some Miocene and Pleistocene Drainage Changes in North Idaho. By Alfred H. Anderson.

Pamphlet 21. The Vienna District, Blaine Co., Idaho. By Clyde T. Ross.

Pamphlet 22. Ore Deposits in Tertiary Lava in the Salmon River Mountains, Idaho. By Clyde P. Ross.

Pamphlet 24. Underground Water Resources in the Vicinity of Oro Vino, Idaho, and Lapwai, Idaho. By Virgil P. D. Kirkham.

Illinois Department of Registration and Education, Division of the State Geological Survey: Petroleum No. 11. Recent Developments in the Vicinity of Jacksonville. By Alfred H. Bell.

Petroleum No. 12.

Kentucky Geological Survey:

Geology of the Island Creek Oil Pool. By Willard Rouse Jillson.

Geology of the Oil Shales of Eastern United States. By Willard Rouse Jillson.

Geology of the Pennyroyal. A Study of the Influence of Geology and physiography upon the Industry, Commerce and Life of the People. By Carl Ortwin Sauer.

North Carolina Department of Conservation and Development: Conservation Laws of North Carolina, July, 1927.

Oklahoma Geological Survey: Bulletin 35. Index to the Stratigraphy of Oklahoma. By Chas. N. Gould.

San Diego Society of Natural History:

Vol. II, No. 1. A Preliminary List of the Hemipters of San Diego County. By E. P. Van Dazee.

No. 2. The Variation Exhibited by Ancistrodon halys (Pallas). By Joseph C. Thompson.

No. 3.

Vol. III, No. 1. Palaeozoic Crustacea. By Anthony Wayne Vogdes.

No. 2.

No. 3.

No. 4.

Vol. IV, No. 1. Part I—Bibliography of Palaeozoic Crustacea.
Part II—List of the Genera and Subgenera of the Trilobita.
Part III—Historical Summary of the Ordovician Genus Cybele Loven. By Anthony Wayne Vogdes.

Vol. V, No. 1.

No. 2.

No. 3. The New Geometridae from San Diego County, California. By William S. Wright.

No. 4. Foraminifera from the Eocene near San Diego, California. By Joseph A. Cushman and Marcus A. Hanna.

No. 5.

No. 6. Late Tertiary and Quaternary Elphidiums of the West Coast, North America. By Joseph A. Cushman and U. S. Grant, IV.

No. 7.

South Dakota School of Mines: Bulletin 15—The Tertiary Mineralization of the Northern Black Hills. By Jos. P. Connolly.

Virginia State Chamber of Commerce: Minerals of Virginia, Their Appearance and Uses. Document No. 1.

Wisconsin Geological and Natural History Survey: Vol. 68, Soil Series No. 49. Soil of Wisconsin. By A. R. Whitson.

Argentina Ministerio de Agricultura de la Nacion:

Publicacion No. 29. Production de Petroleo, en la Republica Argentina durante el Ano 1926.

Publicacion No. 31. Las Minas del Fraile y Sierra de Zapata. By Sven Wassman.

Publicacion No. 32. Los Estratos con Dinosaurios y su Techo.

Publicacion No. 33. Resultados de un Viaje de Estudios Geologicos en los Territorios del Rio Negro y del Chubuit. By Ricardo Wickmann.

Publicacion No. 30. Sobre las Minas de Estano en la Region del Fraile y Sierra de Zapata. By N. A. Lannefors.

Barcelona Real Academia de Ciencias y Artes:

Memorias de la Vol. XX, Num. 5. Metodos Monernos de Mejora y Obtension de Variedades de Plantas.

Vol. XX, Num. 6. Las Exploraciones Arqueologicas en Creta e Interes de los Ultimos Descubrimientos.

Summario, Vol. V, Num. 4.

Vol. XX, Num. 2. El Principio de Contradiccion en la Geometria no Euclidea y en el Principio de Relatividad. By D. Jose Tous y Biaggi.

Vol. XX, Num. 3. Monografia de los Bombylidos de las Islas Canarias. By Dr. D. Elias Santos Abreu.

Vol. XX, Num. 4. La Flora de las Pitiusas y sus Afinidades con la de la Peninsula Iberica.

Canada Department of Mines:

Abrasives Products of Canada, Technology and Application, Part I. Siliceous Abrasives. By V. L. Eardley-Wilmot.

Use of Alberta Bituminous Sands for Surfacing of Highways. By S. C. Ells.

Memoir 152. St. Urbain Area, Charlevoix District, Quebec. By J. B. Mawdsley.

Memoir 151. Mino Coal Basin, New Brunswick. By W. S. Dyer.

Summary Report, 1925, Part C.

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Preliminary Report on the Limestones of Quebec and Ontario. By M. F. Goudge.

Canadian Institute of Mining and Metallurgy: Bulletin No. 184. Official Programme of the Second Biennial Empire Mining and Metallurgical Congress, Aug. 22 to Sept. 28, 1927.

Canadian Mining and Metallurgical Bulletin No. 185.
Bulletin No. 186.

England and Wales, Department of Scientific and Industrial Research, Memoirs of: The Geology of the Southern Part of the South Staffordshire Coal Field. By Talbot H. Whitehead and T. Eastwood.

Great Britain Geological Survey and Museum of Practical Geology, Summary of Progress of, for year of 1926.

The Geology of the South Wales Coal Field. Part II. Abergavenny, Second Division, 1927. By Aubrey Strhan and Walcot Gibson.

The Geology of the Country Around Ipswich. By P. G. H. Boswell.

The Geology of the Country Around Wrexham. By C. B. Wedd, B. Smith and L. J. Wills.

Manchuria Geological and Mining Review, No. 68.

Mexico Secretaria de Industria, Commercio y Travajo. Boletin Minero, Tomo XXIV, Numero 1.

Boletin del Petroleo, Vol. XXIII, Num. 6.
Vol. XXIII, Num. 4.

New South Wales: Annual Report of the Department of Mines, for the year 1926.

Ontario Department of Mines:

Bulletin 61. Mineral Production of Ontario, January to June, 1927.

Bulletin 25. List of Publications, including Reports Vols. 1 to 35, 1891 to 1926. Also Maps and Bulletins.

35th Annual Report, Parts 4, 5 and 6. Reconnaissance from Red Lake to Favourable Lake, District of Patricia. By G. Vibert Douglas.
Parts 1, 2 and 3.

Philippine Journal of Science, Vol. 33, No. 3, July, 1927.
No. 4, August, 1927.

Queensland Undersecretary of Mines, Annual Report for the year 1926.

Queensland, Royal Society of, Proceedings of, 1925, Vol. 37.
Vol. 38, 1926.

Rio de Janeiro, Boletin do Museu National do,
Vol. II, No. 6.
Vol. III, No. 1.

Scotland Geological Survey: Memoirs. The Oil Shales of the Lothians.

South Australia, Transactions and Proceedings of, Vol. L.

Transvaal Chamber of Mines, 1926. The Wage Position of the Witwatersrand Gold Mine.
37th Annual Report for the year 1926.

Victoria Geological Survey, Department of Mines: Bulletins of the Geological Survey 149. Some Mines of Maldon. By J. J. Caldwell, H. S. Whitelaw and D. J. Mahoney.

Western Australia Geological Survey:
Bulletin 85. The Geological Reconnaissance of Part of the Ashburton Drainage Basin, with Notes on the Country Southwards to Meekatharra. By H. W. D. Talbot.
Bulletin 93. The Geology of Portions of the Kimberley Division, with Special Reference to the Fitzroy Basin and the Possibilities of Occurrence of Mineral Oil. By T. Blatchford.
Bulletin 87. A Geological Reconnaissance in the Central and Eastern Divisions. By H. W. D. Talbot.

American Mineralogist, Journal of the Mineralogical Society of America, Vol. 12, No. 10, Oct. 1927.

Economic Geology, Vol. 22, No. 6, September-October, 1927.

Engineers Society of Western Pennsylvania, Proceedings of;
Vol. 43, No. 5.
Vol. 43, No. 4.

Institution of Mining and Metallurgy, Transactions of, 35th Session, 1925-1926, Vol. 35.
Bulletin 275, September, 1927.

Smithsonian Institution, Annual Report of, 1926.

Western Society of Engineers, Journal of, September, 1927.
Vol. 32, No. 8.
Vol. 32, No. 6, Part II.

Maps.

Topographic Maps:
New Martinsville, W. Va.–Ohio.
Holbrook, W. Va.
Pinckneyville, Ill.
Roodhouse, Ill.
Weston, W. Va.
Parsons, W. Va.
Ivanhoe, California.
Griggsville, Ill.
Draper, Va.–N. C.

Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

American Petroleum Institute, New York.
Architect and Engineer, San Francisco.
Arizona Mining Journal, Phoenix, Arizona.
Asbestos, Philadelphia, Pennsylvania.
Brick and Clay Record, Chicago.

Bulletin, Union Oil Co., Los Angeles.
California Journal of Development, San Francisco.
Cement, Mill and Quarry, Chicago, Illinois.
Chemical-Engineering and Mining Review, Melbourne, Australia.
Engineering and Mining Journal, New York.
Explosives Engineer, Wilmington, Del.
Financial Insurance News, Los Angeles, California.
Graphite, Jersey City.
Journal of Electricity and Western Industry, San Francisco.
Metallurgical and Chemical Engineering, New York.
Mine and Quarry, Chicago.
Mining and Engineering Record, Vancouver, B. C.
Mining and Oil Bulletin, Los Angeles.
Oil Age, Los Angeles.
Oil and Gas Journal, Tulsa, Oklahoma.
Oil and Gas News, Kansas City.
Oil News, Galesburg, Illinois.
Oildom, New York.
Oil, Paint and Drug Reporter, New York.
Oil Trade Journal, New York.
Oil Weekly, Houston, Texas.
Petroleum Age, New York.
Petroleum Record, Los Angeles.
Petroleum World, Los Angeles.
Queensland Government Mining Journal, Brisbane, Australia.
Rock Products, Chicago, Illinois.
Safety News, Industrial Accident Commission, San Francisco.
Salt Lake Mining Review, Salt Lake City, Utah.
Southwest Builder and Contractor, Los Angeles
Standard Oil Bulletin, San Francisco.
Stone, New York.
The Record, Associated Oil Company, San Francisco.
Through the Ages, Baltimore.

Newspapers.

The following papers are received and kept on file in the library

Amador Dispatch, Jackson, Cal.
Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas)
Barstow Printer, Barstow, Cal.
Blythe Herald, Blythe, Cal.
Bridgeport Chronicle-Union, Bridgeport, Mono Co., Cal
Calaveras Prospect, San Andreas, Cal.
California Oil World, Los Angeles, Cal.
Cloverdale Reveille, Cloverdale, Cal.
Colusa Daily Sun, Colusa, Cal.
Daily Commercial News, San Francisco, Cal.
Daily Midway Driller, Taft, Cal.
Del Norte Triplicate, Crescent City, Cal.
Exeter Sun, Exeter, Cal.
Gateway Gazette, Beaumont, Cal.
Goldfield News, Goldfield, Nevada.
Guerneville Times, Guerneville, Cal.
Healdsburg Enterprise, Healdsburg, Cal.
Humboldt Standard, Eureka, Cal.
Inyo Independent, Independence, Cal.
Inyo Register, Bishop, Cal.
Ione Valley Echo, Ione, Cal.
Lake County Bee, Lakeport, Cal.
Mining and Financial Record, Denver, Colo.
Mining Topics, San Francisco, Cal.
Mountain Democrat, Placerville, Cal.
Mountain Messenger, Downieville, Cal.
Nevada Mining Press, Reno, Nevada.
Oatman Mining News, Oatman, Arizona.

Oregon Observer, Grants Pass, Oregon.
Oroville Daily Register, Oroville, Cal.
Petroleum Reporter, Taft, Cal.
Placer Herald, Auburn, Cal.
Plumas Independent, Quincy, Cal.
Plumas National Bulletin, Quincy, Cal.
Randsburg Times, Randsburg, Cal.
San Diego News, San Diego, Cal.
Shasta Courier, Redding, Cal.
Siskiyou News, Yreka, Cal.
Stockton Record, Stockton, Cal.
Tuolumne Prospector, Tuolumne, Cal.
Ventura Daily Post, Ventura, Cal.
Weekly Trinity Journal, Weaverville, Cal.
Western Sentinel, Etna Mills, Cal.

PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

When the publication of MINING IN CALIFORNIA was on a monthly basis, current inquiries from buyers and sellers were summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to the present quarterly publication of MINING IN CALIFORNIA, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes,' and sent to those on the mailing list for MINING IN CALIFORNIA.

EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate attention.

Technical men, or those qualified for supervisory positions, and vacancies of like nature, only are registered, as no attempt will be made to supply common mine and mill labor.

A list of current applications for positions and 'positions open' is carried in each issue. Notices are designated by a key number, and the name and address corresponding to any number will be supplied upon request, without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Division of Mines and Mining, to avoid possible loss. Registration cards for the use of both prospective employers and employees may be obtained upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

POSITIONS WANTED.

51-12 Assayer-Accountant. Eighteen years' experience, Mother Lode mines. Widower. Salary open.

51-13 Chemist. Six years' experience. Age 25. Single. References. Salary wanted, $140–$150.

51-14 Draftsman-Instrument Man. Twenty years' general experience, R. R., etc. Salary open.

51-15 Flotation Operator or Mill Shift Boss. Graduate mining engineer. Seven years 'experience. Age 32. Single. References. Salary wanted, $175.

51-16 Mine Manager. University graduate. Twenty-five years' experience, foreign and domestic. Age 44. Married. References. Salary wanted, $350–$450 per month.

51-17 Examinations, Mine Management, Superintendent or Assayer. Twenty-two years' experience. Read, write and speak Spanish fluently. Age 47. Married. References. Salary open.

51-18 Surveying, Mill Construction, Mine Superintendent. Over twenty years' foreign and domestic experience. Speaks Spanish fluently. Age 45. Married. Reference. Salary open.

PUBLICATIONS OF THE DIVISION OF MINES AND MINING.

During the past forty-four years, in carrying out the provisions of the organic act creating the former California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the office of the Division of Mines and Mining, in the Ferry Building, San Francisco; New Orpheum Building, Los Angeles; Chamber of Commerce Building, Sacramento; Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the above offices and enclosing the requisite amount in the case of publications that have a list price. Only coin, stamps or money orders should be sent, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the Division of Mines and Mining.

REPORTS.

Asterisks (**) indicate the publication is out of print.

	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks	----
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks	----
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks	----
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks	----
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks	----
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. Henry G. Hanks	----
**Part II, 1887, 222 pp., 36 illustrations. William Irelan, Jr.	----
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Irelan, Jr.	----
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustrations. William Irelan, Jr.	----
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Irelan, Jr.	----
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Irelan, Jr.	----

REPORTS—Continued.

Asterisks (**) indicate the publication is out of print.

Price

Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps. William Irelan, Jr. $1.00

**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps. J. J. Crawford ----

**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford ----

Chapters of the State Mineralogist's Report, Biennial Period, 1913–1914, Fletcher Hamilton:

**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper ----

Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper .50

Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper .25

**Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pages, paper ----

Mines and Mineral Resources of Imperial and San Diego Counties, 113 pp., paper .35

**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper ----

**Fourteenth Report of the State Mineralogist, for the Biennial Period 1913-1914, Fletcher Hamilton, 1915:

A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth ---

Chapters of the State Mineralogist's Report, Biennial Period, 1915–1916, Fletcher Hamilton:

**Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp., paper ----

**Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama Counties, 91 pp., paper ----

Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper .65

Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper .65

Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties, 136 pp., paper .50

**Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp., paper ----

**Fifteenth Report of the State Mineralogist, for the Biennial Period 1915-1916, Fletcher Hamilton, 1917:

A General Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 980 pp., 413 illustrations, cloth ----

Chapters of the State Mineralogist's Report, Biennial Period 1917-1918, Fletcher Hamilton:

Mines and Mineral Resources of Nevada County, 270 pp., paper .75

Mines and Mineral Resources of Plumas County, 188 pp., paper .50

Mines and Mineral Resources of Sierra County, 144 pp., paper .50

Seventeenth Report of the State Mineralogist, 1920, Mining in California during 1920, Fletcher Hamilton: 562 pp., 71 illustrations, cloth 1.75

REPORTS—Continued.

Asterisks (**) indicate the publication is out of print. Price

Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with January, 1922:

**January, **February, March, April, May, June, July, August, September, October, November, December, 1922 ---------- Free

Chapters of Nineteenth Report of the State Mineralogist, 'Mining in California,' Fletcher Hamilton and Lloyd L. Root. January, February, March, September, 1923 ---------- Free

Chapters of Twentieth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly. January, April, July, October, 1924, per copy ---------- $0.25

Chapters of Twenty-first Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly.

January, 1925, Mines and Mineral Resources of Sacramento, Monterey and Orange counties ---------- .25

April, 1925, Mines and Mineral Resources of Calaveras, Merced, San Joaquin, Stanislaus and Ventura counties ---------- .25

July, 1925, Mines and Mineral Resources of Del Norte, Humboldt and San Diego counties ---------- .25

October, 1925, Mines and Mineral Resources of Siskiyou, San Luis Obispo and Santa Barbara counties ---------- .25

Subscription, $1.00 in advance (by calendar year, only).

Chapters of Twenty-second Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly.

January, 1926, Mines and Mineral Resources of Trinity and Santa Cruz counties ---------- .25

April, 1926, Mines and Mineral Resources of Shasta, San Benito and Imperial counties ---------- .25

July, 1926, Mines and Mineral Resources of Marin and Sonoma Counties ---------- .25

October, 1926, Mines and Mineral Resources of El Dorado and Inyo counties, also report on Minaret District, Madera County ---------- .25

Chapters of Twenty-third Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly.

January, 1927, Mines and Mineral Resources of Contra Costa County; Santa Catalina Island ---------- .25

April, 1927, Mines and Mineral Resources of Amador and Solano counties ---------- .25

July, 1927, Mines and Mineral Resources of Placer and Los Angeles counties .25

Chapters of State Oil and Gas Supervisor's Report:

Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume) ---------- Free

Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:

**April, **May, June, **July, **August, **September, **October, November, **December, 1919 ---------- Free

January, February, March, April, **May, June, July, **August, September, October, November, December, 1920 ---------- Free

January, **February, **March, **April, May, June, **July, August, **September, **October, **November, **December, 1921 ---------- Free

January, February, March, April, May, June, July, August, September, October, November, December, 1922 ---------- Free

January, February, March, April, May, June, July, August, September, October, November, December, 1923 ---------- Free

January, February, March, April, May, June, July, August, September, October, November, December, 1924 ---------- Free

January, February, March, April, May, June, July, August, September, October, November, December, 1925 ---------- Free

January, February, March, April, May, June, July, August, September, October, November, December, 1926 ---------- Free

January, 1927 ---------- Free

BULLETINS.

Asterisks (**) indicate the publication is out of print. Price

**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations ----
**Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations ----
**Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps ----
**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.) ----
**Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations ----
Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston. 85 pp., 46 illustrations $0.50
**Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 9. Mine Drainage, Pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations ----
**Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp. ----
**Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps, 31 illustrations ----
**Bulletin No. 12. Mineral Production of California, by Counties for 1896, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 13. Mineral Production of California, by Counties for 1897, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 14. Mineral Production of California, by Counties for 1898, by Charles G. Yale ----
**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H. Means. 1899 ----
**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations ----
**Bulletin No. 17. Mineral Production of California, by Counties for 1899, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations ----
**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps ----
**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years ending December, 1899 ----
**Bulletin No. 21. Mineral Production of California by Counties, by Charles G. Yale. 1900. Tabulated sheet ----
**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet ----
Bulletin No. 23. The Copper Resources of California, by P. C. DuBois, F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69 illustrations, and 9 maps .50
**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps ----
**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 26. Mineral Production of California for the past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet ----
**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps ----
**Bulletin No. 28. Mineral Production of California, for 1902, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet ----

BULLETINS—Continued.

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**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology, and Mineral Resources of California, by A. W. Vogdes. 1903, 290 pp. ----

**Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N. Cooper. 1904. Tabulated sheet ----

**Bulletin No. 32. Production and Use of Petroleum in California, by Paul W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps ----

**Bulletin No. 33. Mineral Production of California, by Counties, for 1903, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 34. Mineral Production of California for Seventeen Years, by Charles G. Yale. 1904. Tabulated sheet ----

**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale. 1904, 55 pp., 20 county maps. Relief map of California ----

**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905, 120 pp., 66 illustrations, 3 maps ----

**Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of California, by George F. Kunz. 1905. 168 pp., 54 illustrations ----

**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906, 412 pp., 150 illustrations, 1 map ----

**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet ----

**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles G. Yale. 1905, 54 pp., 20 county maps ----

**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 43. Mineral Production of California for Nineteen Years, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G. Yale. 1907, 31 pp., 20 county maps ----

**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907. 10 pp. ----

Bulletin No. 46. General Index of Publications of the California State Mining Bureau, by Charles G. Yale. 1907. 54 pp. $0.30

**Bulletin No. 47. Mineral Production of California, by Counties, 1906, by Charles G. Yale. Tabulated sheet ----

**Bulletin No. 48. Mineral Production of California for Twenty Years. 1906, by Charles G. Yale ----

**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles G. Yale. 34 pp. ----

Bulletin No. 50. The Copper Resources of California, 1908, by A. Hausmann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp., 74 illustrations. (Revised edition.) 1.00

**Bulletin No. 51. Mineral Production of California, by Counties, 1907, by D. H. Walker. Tabulated sheet ----

**Bulletin No. 52. Mineral Production of California for Twenty-one Years, 1907, by D. H. Walker. Tabulated sheet ----

**Bulletin No. 53. Mineral Production of California for 1907, with County Maps, by D. H. Walker, 62 pp. ----

**Bulletin No. 54. Mineral Production of California, by Counties, by D. H. Walker, 1908. Tabulated sheet ----

**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet ----

**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by D. H. Walker. 78 pp. ----

**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps ----

**Bulletin No. 58. Mineral Production of California, by Counties, by D. H. Walker, 1909. Tabulated sheet ----

**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker, 1909. Tabulated sheet ----

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print. Price

**Bulletin No. 60. Mineral Production for 1909, County Maps and Mining Laws of California, by D. H. Walker. 94 pp. ----
**Bulletin No. 61. Mineral Production of California, by Counties for 1910, by D. H. Walker. Tabulated sheet ----
**Bulletin No. 62. Mineral Production of California for Twenty-four Years, by D. H. Walker, 1910. Tabulated sheet ----
**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman. 1912, 430 pp., 41 illustrations, 6 maps ----
**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp. ----
**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp. ----
**Bulletin No. 66. Mining Laws of the United States and California. 1914, 89 pp. ----
**Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914, 226 pp. ----
**Bulletin No. 68. Mineral Production for 1913, with County Maps and Mining Laws, by E. S. Boalich. 160 pp. ----
**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps (18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.] ----
**Bulletin No. 70. Mineral Production for 1914, with County Maps and Mining Laws. 184 pp. ----
**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations ----
Bulletin No. 72. The Geologic Formations of California, by James Perrin Smith. 1916, 47 pp. $0.25
**Reconnaissance Geologic Map (of which Bulletin 72 is explanatory), in 23 colors. Scale: 1 inch = 12 miles. Mounted ----
**Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the fiscal year 1915–16, by R. P. McLaughlin. 278 pp., 26 illustrations ----
Bulletin No. 74. Mineral Production of California in 1916, with County Maps, by Walter W. Bradley. 179 pp., 12 illustrations Free
**Bulletin No. 75. United States and California Mining Laws, 1917. 115 pp., paper ----
Bulletin No. 76. Manganese and Chromium in California, by Walter W. Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A. Waring, 1918. 248 pp., 51 illustrations, 5 maps, paper .50
Bulletin No. 77. Catalogue of Publications of California State Mining Bureau, 1880–1917, by E. S. Boalich. 44 pp., paper Free
Bulletin No. 78. Quicksilver Resources of California, with a Section on Metallurgy and Ore-Dressing, by Walter W. Bradley, 1918. 389 pp., 77 photographs and 42 plates (colored and line cuts), cloth 1.50
Bulletin No. 79. Magnesite in California, by Walter W. Bradley, 1925, 147 pp., 62 photographs, 11 line cuts and maps, cloth 1.00
Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California. (In preparation.) ----
Bulletin No. 81. Foothill Copper Belt of California. (In preparation.) ----
**Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1916–1917, by R. P. McLaughlin, 1918. 412 pp., 31 illustrations, cloth ----
Bulletin No. 83. California Mineral Production for 1917, with County Maps, by Walter W. Bradley. 179 pp., paper Free
**Bulletin No. 84. Third Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1917–1918, by R. P. McLaughlin, 1918. 617 pp., 28 illustrations, cloth ----
**Bulletin No. 85. Platinum and Allied Metals in California, by C. A. Logan, 1919. 10 photographs, 4 plates, 120 pp., paper ----
Bulletin No. 86. California Mineral Production for 1918, with County Maps, by Walter W. Bradley, 1919. 212 pp., paper Free
**Bulletin No. 87. Commercial Minerals of California, with notes on their uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello. 1920. 124 pp., paper ----

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
Bulletin No. 88. California Mineral Production for 1919, with County Maps, by Walter W. Bradley, 1920. 204 pp., paper	Free
**Bulletin No. 89. Petroleum Resources of California, with Special Reference to Unproved Areas, by Lawrence Vander Leck, 1921. 12 figures, 6 photographs, 6 maps in pocket, 186 pp., cloth	----
Bulletin No. 90. California Mineral Production for 1920, with County Maps, by Walter W. Bradley, 1921. 218 pp., paper	Free
Bulletin No. 91. Minerals of California, by Arthur S. Eakle, 1923, 328 pp., cloth	$1.00
Bulletin No. 92. Gold Placers of California, by Chas. S. Haley, 1923. 167 pp., 36 photographs and 7 plates (colored and line cuts, also geologic map), cloth	1.50
Extra copies of the Geologic Map (in 4 colors)	.50
Bulletin No. 93. California Mineral Production for 1922, by Walter W. Bradley, 1923, 188 pp., paper	Free
Bulletin No. 94. California Mineral Production for 1923, by Walter W. Bradley, 1924. 162 pp., paper	Free
Bulletin No. 95. Geology and Ore Deposits of the Randsburg Quadrangle, by Carlton D. Hulin, 1925. 152 pp., 49 photographs, 13 line cuts, 1 colored geologic map, cloth	2.00
Bulletin No. 96. California Mineral Production for 1924, by Walter W. Bradley, 1925. 173 pp., paper	Free
Bulletin No. 97. California Mineral Production for 1925, by Walter W. Bradley, 1926. 172 pp., paper	Free
Bulletin No. 100. California Mineral Production for 1926, by Walter W. Bradley, 1927. 174 pp., paper	Free

PRELIMINARY REPORTS.

Asterisks (**) indicate the publication is out of print.

**Preliminary Report No. 1. Notes on Damage by Water in California Oil Fields, December, 1913. By R. P. McLaughlin. 4 pp.	----
**Preliminary Report No. 2. Notes on Damage by Water in California Oil Fields, March, 1914. By R. P. McLaughlin. 4 pp.	----
Preliminary Report No. 3. Manganese and Chromium, 1917. By E. S. Boalich. 32 pp.	Free
Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper	Free
Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper	Free
**Preliminary Report No. 6. A Review of Mining in California During 1919. Fletcher Hamilton, 1920. 43 pp. Paper	----
**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker, 1920. 102 pp. 24 illustrations. Paper	----
**Preliminary Report No. 8. A Review of Mining in California During 1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922. 68 pp. Paper	----

MISCELLANEOUS PUBLICATIONS.

Asterisks (**) indicate the publication is out of print.

**First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 1881. 350 pp.	----
**Catalogue of books, maps, lithographs, photographs, etc., in the library of the State Mining Bureau at San Francisco, May 15, 1884. 19 pp.	----
**Catalogue of the State Museum of California, Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220 pp.	----
**Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31, 1887. 195 pp.	----

MISCELLANEOUS PUBLICATIONS—Continued.

Asterisks (**) indicate the publication is out of print. Price

**Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August 20, 1890. 261 pp. ----
**Catalogue of the Library of the California State Mining Bureau, September 1, 1892. 149 pp. ----
**Catalogue of West North American and Many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894 ----
**Report of the Board of Trustees for the four years ending September, 1900. 15 pp. Paper ----
Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers. 1901. 19 pp. 2 illustrations. Paper Free
Commercial Mineral Notes. A monthly mimeographed sheet, beginning April, 1923 Free

MAPS.

Register of Mines With Maps.

Asterisks (**) indicate out of print.

**Register of Mines, with Map, Amador County ----
**Register of Mines, with Map, Butte County ----
**Register of Mines, with Map, Calaveras County ----
**Register of Mines, with Map, El Dorado County ----
**Register of Mines, with Map, Inyo County ----
**Register of Mines, with Map, Kern County ----
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Topographic Map of Sierra Nevada Gold Belt, showing distribution of auriferous gravels, accompanying Bulletin No. 92 (also sold singly) In 4 colors	.50

OIL FIELD MAPS.

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DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the state may be sent to the Division of Mines and Mining for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

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STATE OF CALIFORNIA

DIVISION OF MINES AND MINING

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THE DEVELOPMENT OF THE

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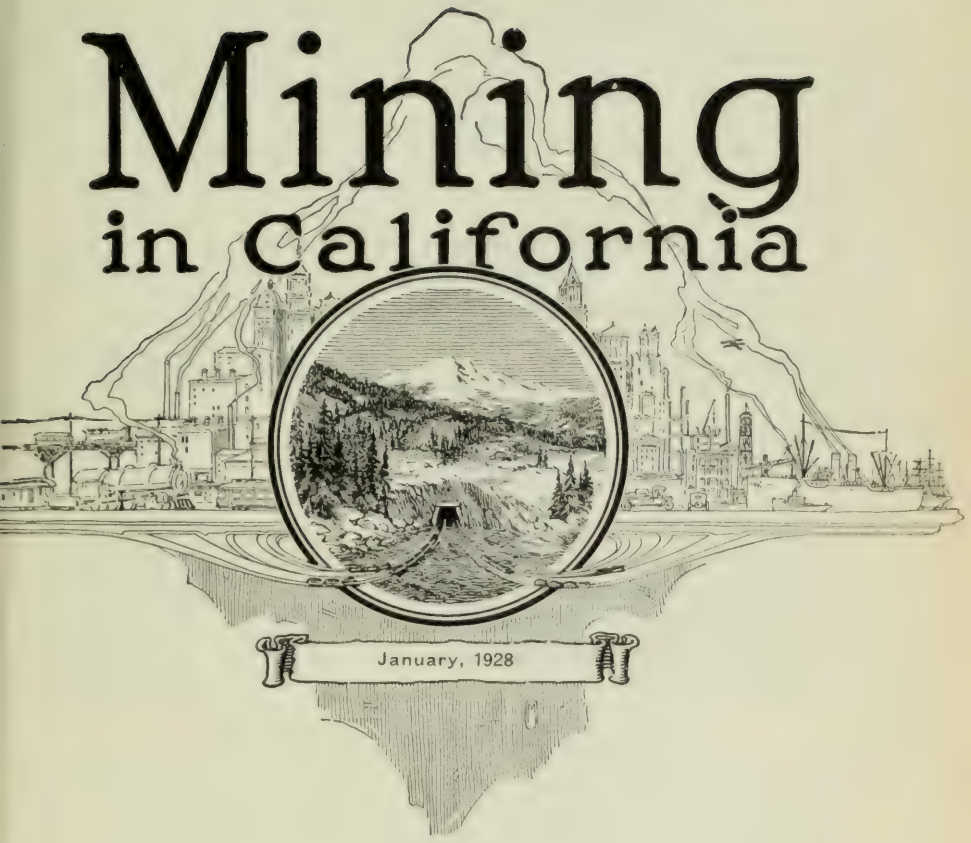
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January, 1928

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Note.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the Division of Mines and Mining, entitled 'Summary of Operations, California Oil Fields.'

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND MINING
FERRY BUILDING, SAN FRANCISCO

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CHAPTER OF

REPORT XXIV OF THE STATE MINERALOGIST

COVERING

MINING IN CALIFORNIA

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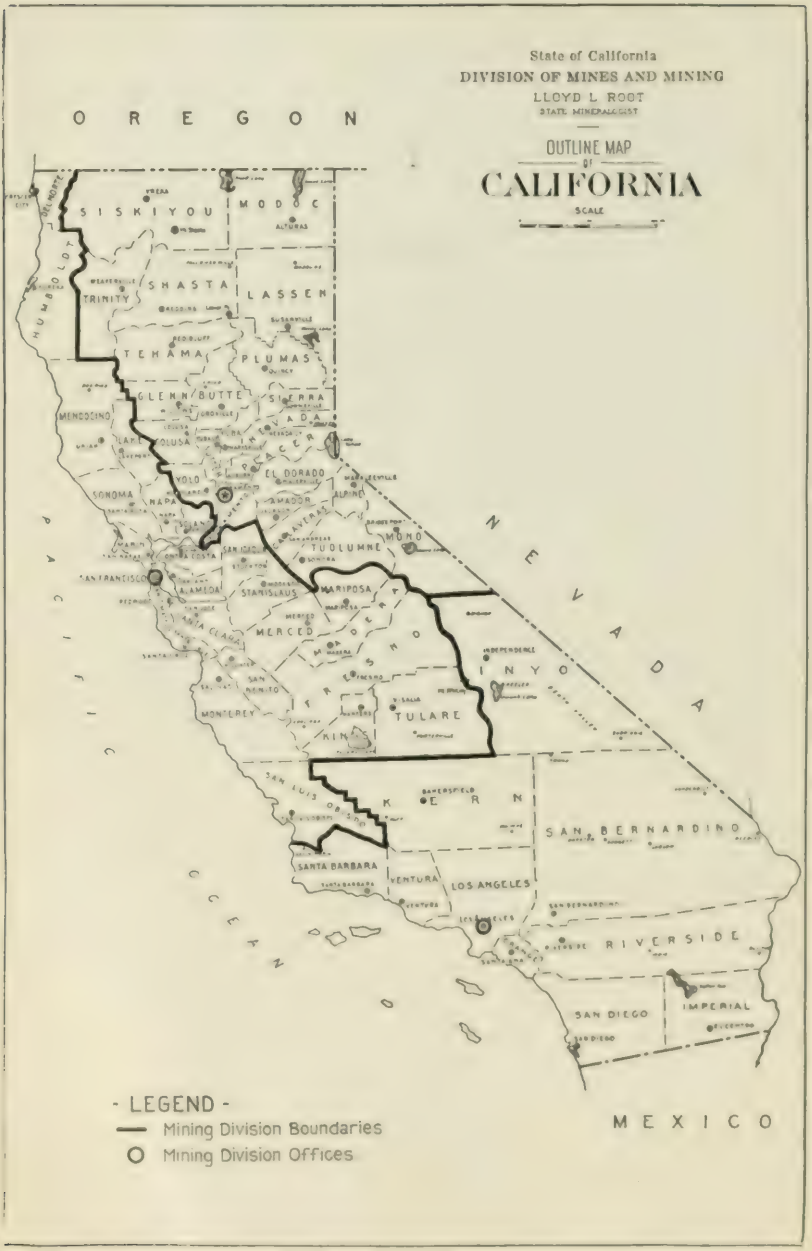
ACTIVITIES OF THE DIVISION OF MINES AND MINING



CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1928

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State of California
DIVISION OF MINES AND MINING
LLOYD L. ROOT
STATE MINERALOGIST
OUTLINE MAP
of
CALIFORNIA
SCALE
OREGON
SISKIYOU
MODOC
SHASTA
TRINITY
LASSEN
TEHAMA
PLUMAS
GLENN
BUTTE
SIERRA
MENDOCINO
LAKE
COLUSA
NEVADA
YOLO
EL DORADO
SONOMA
NAPA
AMADOR
ALPINE
MONO
TUOLUMNE
SAN FRANCISCO
ALAMEDA
STANISLAUS
MARIPOSA
MERCED
INYO
SAN BENITO
MONTEREY
TULARE
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
RIVERSIDE
SAN DIEGO
IMPERIAL
MEXICO
- LEGEND -
Mining Division Boundaries
Mining Division Offices

PREFACE.

The Division of Mines and Mining (formerly State Mining Bureau) is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing this was changed to quarterly publication, beginning in September, 1923.

For the same reason, beginning with the January, 1924, issue, it has been necessary to charge a subscription price of $1 per calendar year, payable in advance; single copies, 25 cents apiece. 'Mining in California' will continue to be sent without charge to our exchange list, including schools and public libraries, as are also other publications of the Division of Mines and Mining.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the practice of issuing from time to time technical reports on special subjects will be continued, as well. A list of such reports now available is appended hereto, and the names of new bulletins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Division of Mines and Mining is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.

DISTRICT REPORTS OF MINING ENGINEERS.

In 1919–1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district, working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively. This move brought the office into closer personal contact with operators, and it has many advantages over former methods of conducting field work. In 1923 the Redding and Auburn field offices were consolidated and moved to Sacramento.

The boundaries of each district were adjusted and the counties now included in each of the three divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

New County Reports.

The series of separate reports on the mines and mineral resources of the different counties, that together comprise the State Mineralogist's Reports XIV to XVII, inclusive, in the case of many of the counties have become exhausted. Those still in stock are in need of revision. It was deemed advisable, therefore, beginning with the January, 1925, issue of 'Mining in California,' to make the district engineers' reports in the form of a complete general report on the mines and mineral resources in one or more of the counties in each district.

This program will be followed as near as possible in succeeding numbers of the quarterly until each county in the state has been covered.

SACRAMENTO FIELD DIVISION.

C. A. Logan, Mining Engineer.

TUOLUMNE COUNTY.

Geography.

The county is separated from Alpine and Mono on the east and north by the summit of the Sierra Nevada. The North Fork of Stanislaus River separates it on the northwest and west from Calaveras. Stanislaus and Mariposa lie on the south. The southern half of the county comprises the entire drainage basin of Tuolumne River and the three forks of Stanislaus River drain the northern part. The western county line extends almost to the San Joaquin Valley, and has an elevation of only 265 feet, but along the eastern border stand many high peaks, including Mt. Lyell, 13,090 feet high, and Mt. Dana, 13,050 feet. Sonora, the county seat, is at an elevation of 1825 feet in the western part. Lumbering is the most important industry, with logging operations extending into the mountains and with plants at Tuolumne, Standard and Sonora. Most of the mining has been in the western section from Confidence (elevation 4200 feet) south and west. Roads enter the county from the west at Melones (Robinson's Ferry) and from Oakdale. The state highway, branching near Chinese Camp, has one branch running through Sonora, Tuolumne, Confidence and over Sonora Pass into Mono County, and the other to Yosemite Valley via Jacksonville and Big Oak Flat. The Sierra Railway of California crosses the western part of the county from Cooperstown to Tuolumne, serving the mines of the Mother Lode and the marble and limestone quarries.

Electric power for mining is available along the Mother Lode and in most of the 'east belt' districts. Timber, of course, is abundant only a few miles east of the Mother Lode. Water has been used at many properties for power, but is being rapidly appropriated for other purposes.

Mineral Resources.

The most important mineral products are gold, marble and limestone. The Mother Lode crosses the western side of the county. An East Belt extends past Tuolumne, Soulsbyville and Arastraville, with many scattered properties in nearby districts. Limestone and marble are abundant, a large belt extending from three miles south of Sonora to the county line north of Columbia and into Calaveras County. The Columbia district has been the seat of an important marble quarrying industry for many years and limestone and lime are being produced near Sonora. Chromite and copper have been produced and in recent years magnesite deposits have been opened, but there is no mining of these minerals now going on. Soapstone, clay, diatomaceous earth and mineral paint deposits are known but undeveloped.

MINERAL PRODUCTION OF

Year	Gold, value	Silver, value	Lime		Limestone	
			Barrels	Value	Tons	Value
1880	$461,861	$1,071				
1881	500,000	1,000				
1882	400,000					
1883	320,000					
1884	310,000					
1885	320,903	1,473				
1886	432,438	1,551				
1887	504,662	3,166				
1888	475,000	3,500				
1889	446,300	543				
1890	1,500,629	13,062				
1891	1,384,950	139				
1892	1,092,549	911				
1893	354,734	1,329				
1894	547,448	1,072				
1895	666,754	313				
1896	1,070,141	328				
1897	1,809,572	1,696				
1898	1,734,953	15,582				
1899	1,635,769	15,111				
1900	1,596,891	62,367				
1901	1,670,368	39,787				
1902	1,791,829	6,580				
1903	1,732,572	13,989	1,600	$1,600		
1904	1,563,907	12,963				
1905	1,291,726	21,348	500	1,000		
1906	1,039,675	8,476	500	1,000		
1907	806,875	6,453	110,000	125,000		
1908	798,752	11,732	60,000	69,500	1,233	$6,500
1909	925,703	4,384	60,000	60,000	15,057	28,942
1910	615,626	5,754	78,300	78,300	3,600	10,400
1911	1,093,484	13,243	75,000	70,000	4,319	13,609
1912	1,113,291	25,146	117,450	121,250	11,554	20,099
1913	974,409	24,381	75,000	85,000	12,446	20,676
1914	940,793	12,017	63,331	38,000	16,707	21,907
1915	1,058,103	13,480	[2]		8,859	11,349
1916	868,237	17,039	[2]		3,137	5,132
1917	321,085	7,808	[2]		3,287	6,481
1918	274,328	21,425	[2]		3,064	5,600
1919	471,021	11,076	[2]		[2]	
1920	254,569	6,007	[2]		7,494	15,288
1921	96,026	2,505	[2]		3,650	9,475
1922	222,366	2,976				
1923	261,936	2,801			3,140	7,680
1924	255,994	1,106			8,515	19,983
1925	155,592	614				[4]268,000
1926	119,873	1,119				
Totals	$38,283,694	$418,423	641,681	$650,650	106,062	$481,121

[1] Includes mineral paint and sandstone.
[2] Includes granite, lime, magnesite, marble.
[3] Includes clay, dolomite, granite, lime, marble.
[4] Includes lime.
[5] Includes dolomite, granite, marble.
[6] Includes granite, lead, lime, limestone, magnesite, marble, silica.
[7] Annual production figures for certain minerals, such as limestone and marble, are concealed under miscellaneous and unapportioned items because there was only one producer of each of these minerals.

TUOLUMNE COUNTY, 1880-1926.

Marble		Copper		Miscellaneous stone[1], value	Miscellaneous and unapportioned[7]		
Cubic feet	Value	Pounds	Value		Amount	Value	Substance
					800 M.	$2,288	Brick.
						1,301	Unapportioned, 1900-1909.
					400 lbs.	16	Lead.
7,000	$14,000	155,826	$17,920				
11,550	28,875				10,367 cu. ft.	14,020	Granite.
11,500	28,750				9,700 cu. ft.	9,700	Granite.
11,000	66.000				9,700 cu. ft.	9,700	Granite.
23,000	46 000				9,700 cu. ft.	9,700	Granite.
					197 tons	1,379	Chromite
22,030	60,120						
18,503	47,165	140,000					
27,600	107,400	9,086	1,154		30 tons	180	Chromite.
17,360	45,400				2,502 lbs.	111	Lead
18,966	50,398						
27,720	73,920						
37,312	93,726	893	138		893 lbs.	53	Lead.
21,830	38,202	45	6		89 lbs.	3	Lead.
					352 tons	2,352	Chromite.
[2]		27,667	4.842	$1,900	1,779 lbs.	84	Lead.
						79,328	Dolomite, lime, marble.
					285 tons	4,556	Chromite.
[2]		1,797	442	1,500	873 lbs.	60	Lead.
						107,296	Dolomite, lime, magnesite, marble.
					2,680 tons	54,290	Chromite.
[2]		32,840	8,960	3,800	997 lbs.	86	Lead.
						108,758	Dolomite, lime, magnesite, marble.
[2]		35,127	8,676	1,700	4,269 tons	168.693	Chromite.
						121,806	Lime, manganese, marble.
[2]		[2]		2,700		110,746	Lime and limestone.
						78,950	Chromite, copper, granite, marble.
[2]				28,696		209,354	Dolomite, lime, marble, platinum.
[2]				229,185		217,292	Dolomite, granite, lime, marble.
				246,460		293,136	Other minerals[4]
				9,800		388,145	Other minerals[2]
				12,500		339,573	Other minerals[3]
				29,751		113,305	Other minerals[5]
		2,332	326	56,097		438,583	Other minerals.[6]
255,371	$699,756	265,613	$42,469	$624,089		$2,884,894	

ASBESTOS.

H. Favot, Moccasin P. O., has a deposit of short-fiber chrysotile asbestos up to one inch in length on the Hetch Hetchy railroad and 1500 feet from a wagon road. There are two claims, on which a little work has been done.

W. E. Finch, Box 583, Sonora, has a deposit of short-fiber asbestos up to one inch long, on a 20-acre claim.

CHROMITE.

Some chromite deposits in the county were productive before 1914, but most of them were actively developed between then and 1919. Serpentine and the rocks from which it is derived, which are the source of this ore, extend along the Mother Lode from the southerly county line near Penon Blanco at intervals almost to the Calaveras County line, and a much larger body of these rocks, three to four miles wide, extends from seven miles southeast of Chinese Camp for many miles in a northwesterly direction. About 500 tons of chromite had been shipped from the Mackey Ranch and half as much from the Marianno Ranch previous to 1914. The other properties in the tabulation below became active in 1916–1917 and produced from one car upward, but most of them yielded only a small tonnage. The total recorded chromite production of the county has been 7813 tons, of which 2680 tons was produced in 1917 and 4269 tons in 1918.

Table of Chromite Deposits, Tuolumne County.

Name	Location	Railroad Station	Ownership
Don Pedro	Sec. 6, T. 2 S., R. 14 E.	8 mi. Keystone	Sold for taxes
Hughes	SE. of Jacksonville		Hughes Bros.
Kahl	Sec 6, T. 1 N., R. 14 E.	6 mi. Jamestown	Jos. Kahl
Mackey	Sec. 21, T. 1 N., R. 14 E.	3 mi. Jamestown	Est. of P. Mackey
Madrid	Near Tuttletown	Tuttletown	
Marianno	Secs. 4, 5, 8, 9, T. 1 S., R. 14 E.	1½ mi. Chinese	J. F. Marianno, Chinese
Rough and Ready	Secs. 25, 26, T. 1 N., R. 14 E.	3½ mi. McCormick	E. T. Richards, et al.
Sims	Sec. 5, T. 1 S., R. 14 E.	1 mi. Chinese	Henry Sims
McCormick	Sec. 2, T. 1 S., R. 13 E.	1 mi. McCormick	M. McCormick Co.

Other operators who worked on unpatented claims between 1916 and 1919, were:

Lighthold & Adams, near Hughes property.

J. Null, Chinese.

Pereira, 540 acres, three miles north of McCormick siding in Sec. 25, T. 1 N., R. 13 E.

H. Pericone, Chinese Camp.

G. M. Porter, et al., Chinese Camp.

A. Swerer, Tuttletown.

C. E. Wilcox, Jamestown.

COPPER.

The foothill copper belt extends across the southwestern end of the county, one branch entering at Byrne's Ferry, west of Chinese, and crossing in a southeasterly direction through the Don Pedro and Corner districts where the Salambo and Oak Hill properties are found. On the so-called east branch of the belt, which enters a mile west of Tuttletown, numerous shallow cuts and shafts are found for a width of several miles extending in a direction about parallel to and west of the Mother Lode, through Chinese Camp to Moccasin Creek. The Oak

Hill and Washington (now the Salambo) have been the principal producers.

Donahue Ranch Prospect is in Sec. 23, T. 2 S., R. 14 E., where an old adit, reported to be 1000 feet long, was driven.

Kahl Ranch in Sec. 6, T. 1 N., R. 14 E., has copper indications which have been slightly prospected.

Mackey Ranch. A copper prospect occurs on this property in SW¼ Sec. 21, T. 1 N., R. 14 E., 2½ miles south of Jamestown. Cholcopyrite occurs in schist and serpentine. In 1915, twelve tons was shipped from a vein a few inches to one foot wide which assayed 9% copper. The ore also carries about $2.50 a ton in gold and silver. The entire copper-bearing vein averages perhaps ten feet wide.

Mann Prospect is in sections 27, 28, T. 1 N., R. 14 E., adjoining the Mackey Ranch on the southeast. The prospect is similar to and a continuation of that on the latter property and is up to 20 feet wide. A few tons of ore has been mined.

Marianno Ranch Prospect is two miles south of Chinese station in the serpentine belt.

Mitchell (Bonne Terre) Mine is a mile west of the Oak Hill Mine. The ore is complex, containing copper, zinc, gold and silver. There is an old shaft 125 feet deep, but no work has been done recently.

Oak Hill Mine is in Sec. 23, T. 2 S., R. 14 E., four miles southeast of Cooperstown, which is on the Sierra Railway. Like so many others of similar character in the foothill copper belt, it was worked first as a gold mine, the upper oxidized portion of the vein paying handsomely to a depth of about 100 feet, where sulphide ore containing pyrite and chalcocite was encountered and at greater depth chalcopyrite. After this early work it lay idle until 1901, from which time it was a small producer at intervals for several years, it being stated that in 1908, 1000 tons of ore carrying 7% copper and several dollars gold per ton was shipped for smelting. The vein occurs in a country rock of augite-porphyrite and two ore shoots were worked, having widths up to six feet each. The principal shaft was 350 feet deep with three levels and a total of nearly one-half mile of underground workings.

Salambo (Washington) Mine is in the southwestern part of the county near the Mariposa County line. It is stated that at one time it supported a village of 400 people, which was burned down, and the mine lay idle many years. It contains three unpatented claims along the porphyrite, where a lens of this greenstone separate from the main mass intrudes the Jurassic slate. Salambo Mining Company, care of L. R. Johnson, Merced, owns the property.

DASH ROCK.

Various kinds of rock have been used the past few years for stucco dash. Hard, clean and brightly colored stones which will not crumble while being crushed or after exposure to the weather are required.

White dolomitic marble has been shipped from the Sonora-Columbia marble belt.

Mariposite and *white quartz* have been shipped from mines on the Mother Lode near Jamestown and Stent.

DIATOMACEOUS EARTH.

This mineral occurs in the extreme western part of the county, near the state highway, but quite a distance from the railroad. It is reported to be a comparatively small deposit but of good grade, and has not been developed.

FLUORSPAR.

W. E. Finch, Box 583, Sonora, reports finding fluorspar in the county but no particulars are available.

GOLD (QUARTZ MINES).

The Mother Lode crosses Tuolumne County from Stanislaus River at Robinson's Ferry, through Whiskey Hill one mile west of Jamestown and through Quartz Mountain and Stent and thence southeast along the east side of Woods Creek and Tuolumne River into Mariposa County. Most of the mines along the lode here have been found in the amphibolite schist or along the contact of the schist, serpentine or other metamorphosed igneous intrusives, with the Calaveras formation. The ore consists largely of altered and mineralized schist or igneous rock, and is in places essentially a dolomite sulphide ore. Near the serpentine and amphibolite the ore may be talcose and in some cases is a complex mixture of talc, dolomite and quartz with 3% to 5% of sulphides, mostly pyrite but with some galena. The larger orebodies are roughly lenticular. Small deposits of rich ore in the form of quartz stringers in Calaveras slate at their contacts with a small dike, made the Jumper and Golden Rule mines famous. At the Rawhide Mine rich ore occurred along a contact of Calaveras rock and serpentine. On Jackass Hill and at Tuttletown, a little east of the line of the lode proper, many pocket mines were worked on quartz stringers or gash veins irregularly distributed in the amphibolite schist. But as a general rule, the Mother Lode ores of this county have been of low or average grade, so that the mines have felt keenly the effect of increased operating costs, and most operations along the lode here have been suspended.

The 'east belt' mines lie east of the Mother Lode in the granodiorite and Calaveras formations. Many of the former gold quartz producers of importance, such as the Black Oak, Confidence, Soulsby, Providence and Dead Horse, are in this group, but at present there are no active producers. These mines, as a group, are on comparatively narrow veins of solid or ribbon quartz, containing small ore shoots of high grade ore carrying free gold, pyrite, galena, zincblende and less common sulphides. The ore may occur at intersections or contacts of the vein with igneous dikes, and in either the granodiorite or Calaveras rocks or at their contact. These mines are scattered over a large area, but share in general the same characteristics.

Between the 'east belt' and the Mother Lode is a group of pocket mines near Sonora and Columbia, which have produced a great deal of gold, and continue to yield small amounts occasionally.

The following notes summarize quartz mining and prospecting operations carried on in the county during the past ten years. There is also given a table of quartz mines, giving the names and locations of such properties, with the ownership as indicated on the county assess-

ment rolls, and a bibliography of state mining bureau publications where the past operations and geology of properties are discussed.

The future of gold mining on the Mother Lode here depends on the application of large-scale operations with a low unit cost. Such ore as is known is low grade. The section of the lode from Robinson's Ferry to the Rawhide Mine has been prospected by shafts (the deepest 1100 feet) and limited exploration, without the development so far of an important producer, but with many low-grade prospects of fair working width reported. The development of this section has been set back many years by the ill-advised erection of a number of mills by small, poorly financed companies, before any ore was assured. The section is not one for small operations. In saying this, the vicinity of Jackass Hill and pocket mines nearby are excepted. The sulphide concentrate is generally low grade so that means of treatment on the property, such as cyanidation, are preferable to avoid the cost of shipment and smelting charges.

Large-scale work has indicated that oil flotation, while successful, did not give decided advantages over the regular stamp-milling and concentration practice, and cost more.

On the East Belt, because the veins are generally narrow and only relatively small tonnages of ore are to be expected, conditions call for small installations. Higher unit costs and higher grades of ore have been the rule. In such mines, following the ore with shafts would seem to be better practice than driving long adits. Mills of five or ten stamps are generally enough. The complex sulphide concentrate does not lend itself so readily to cyanidation, although this practice was followed successfully at the Black Oak Mine. The galena usually present in the best milling ores of this belt has often given losses by sliming when crushed by stamps in the ordinary way.

The following shows the approximate gross production of the principal mines of the county. These figures are in no way official, and have been gathered from various sources. Comparatively few quartz mines have been productive in the county the past ten years and production was distributed previously over such a long period and was made by so many companies now out of existence, that original records are not available.

Approximate Production of Tuolumne County Mines.

Mother Lode Mines.

Alabama	$150,000
App-Heslep	6,500,000
Clio	140,000
Crystalline, about	100,000
Dutch-Sweeney	3,000,000
Eagle Shawmut	5,000,000
Harvard 2,500,000 to	3,000,000
Jumper	5,000,000
Rawhide	6,000,000
Santa Ysabel	1,500,000

East Belt Mines.

Black Oak	3,500,000
Buchanan	600,000
Confidence	$3,250,000
Draper	1,000,000
Excelsior	420,000
Experimental	150,000
Gilson	1,250,000
Green	200,000
Grizzly	1,500,000
Hunter	300,000
Keltz	300,000
New Albany	200,000
Providence	700,000
Soulsby	5,500,000
Spring Gulch	250,000
Other East Belt Mines	1,500,000

Total estimated pocket mine production		$5,500,000
of which the Bonanza produced about	$2,000,000	
Sugarman produced about	350,000	
Jackass Hill Mines produced about	500,000	
Colby produced about	200,000	

Miscellaneous.

Golden Gate	$1,500,000
Patterson	350,000
McCormick	160,000

Alabama claim, on the Mother Lode a mile west of Jamestown and north of the Crystalline, was prospected by Tonopah Mining Company of Nevada in 1922 and 1923. Working through the shaft of the Crystalline mine on the south, they drove a long drift under the Alabama on the 600-ft. level, but gave up their option.

App Mine (See Dutch App Group).

Belmont Shawmut Mine (See Eagle Shawmut).

Bonanza Mine is the most noted of the pocket mines in the county and has been frequently described. It is at the north end of Sonora, at the contact of limestone on the east and Calaveras mica schist on the west. The gold-bearing zone is a diorite dike up to 16 feet thick, with casings of quartz on both walls in the upper part of the mine, and a quartz seam within. It strikes N. 30° E. and dips 20° to 35° NW., crossing the strike and dip of schistosity of the schist.

This mine was discovered in 1851 and has yielded fortunes to several successive groups of owners under romantic circumstances. The total reported output has been between $1,500,000 and $2,000,000, found entirely as 'pocket' gold. The workings, following the dip and cleavage of the slaty schist, have reached a total inclined depth of 2700 feet on an angle of 20°. It is stated that granodiorite was encountered in the bottom.

Black Oak Mine. Although this mine has been closed ten years, a short notice of its operations may be of interest as it was the last of the East Belt mines worked successfully, and by modern methods. It is a mile west of Soulsbyville.

The vein averaged two feet in width, but had a maximum width of 25 feet with branches into the hanging wall and both walls were granodiorite. The ore formed at the crossings of diorite dikes. The vein filling was quartz, diorite and granodiorite. The sulphides arsenopyrite, pyrite, pyrrhotite, marcasite, galena and zincblende occurred, and there were two ounces of silver for each one of gold. A series of reverse faults threw the vein toward the west, looking north. There were three shafts, of which the deepest, and last used was 1800 feet deep on 70° incline, with a winze 100 feet deeper.

The all-sliming method of cyanidation was used. Twenty 1250-lb. stamps dropping six inches 100 times a minute, crushed the ore to 10-mesh in 1.85% cyanide solution. The pulp was classified, coarse passing to a 5-ft. by 18-ft. tube mill, and finely ground ore was thickened to 2 to 1 consistence and treated by agitation in three Pachuca tanks 10 ft. by 30 feet. After this treatment, pulp was thickened, overflow from thickener was pumped to clarification and precipitation presses, and thickened portion was filtered. Resulting solution was again filtered and clarified and the clarified solution was passed to a precipitation press and zinc dust used to precipitate the gold. The recovery was 96% on an ore carrying $13 to $20 a ton. The total operating cost (of mining, milling, developments, etc.) in 1914 was $7.59 a ton. The average treatment cost was reduced from $2.24 a ton (labor and material) in 1914 to $2.08 a ton in 1917, the saving having been made in the labor item. An average of 70 to 75 tons of ore was treated daily. The following material was used per ton of ore

treated: Cyanide, 1.19 lb., lime, 2½ lb., zinc dust, 0.82 lb., litharge, 0.54 lb., pebbles, 5 lb.

Casa Madera Gold Mining Syndicate has continued prospecting its claims near Mt. Lewis, 15 miles by mountain road from Tuolumne. When the prospect was visited October 12 last, the superintendent could not point out any proved ore. After a brief underground and surface inspection, the writer concluded that the recent work, since the adit and raise entered soft ground, has been carried on in a fault zone. From all information obtainable, the workings so far have not revealed a payable orebody, although about 2000 feet of underground work had been done.

A Herman mill with a capacity of 40 tons daily to 10 mesh was installed, and a cyanide plant with a capacity of 200 tons of ore daily, under favorable conditions (but at present without any other primary crushing unit than the above) was completed early in 1927, and a test run was made, but the resulting clean-up was reported disappointing. It is stated that about $300,000 had been raised for the use of the company by the sale of stock and by assessments up to the middle of 1927.

These claims are supplied with electric power over a line three miles long from Confidence. There are two small air compressors, and a hoist from the top of the ridge connects with No. 1 adit. A flow of several inches of water was issuing from the adit when visited. There are several camp buildings.

Chileno, Carrington, Rice, Santissima, Stocker, J. A. Gillis, Wilson & Means, Pine Tree, Last Chance, and other claims on Jackass Hill, near Tuttletown, are in the amphibolite schist east of the Mother Lode. They have been known in the past principally as pocket mines, and most of them were worked only to shallow depths.

In 1922 the group was taken under option by Nevada Wonder Mining Company. On the *Chileno* claim a shaft was sunk to a depth of about 500 feet on an incline of 74° and levels were run at 150 and 450 feet deep. On the 150-ft. level an ore shoot 160 feet long and of good grade was opened. On the 450-ft. level, over 1000 feet of work was done, of which over 500 feet was crosscutting, but results on that level were disappointing, and the option was abandoned.

The Chileno was immediately taken under lease and option by L. L. Coffer and G. L. Warrington, who in March, 1923, put in a Huntington mill. Mark Twain Mining Company was organized soon afterward to work the Chileno. They ran a level at 230 feet in depth and put up a 5-stamp mill with two concentrators. Some ore was stoped between the 230- and 150-ft. levels, and they extended the 450-ft. level, but had suspended work here when the property was visited November 30, 1927, and were prospecting the nearby Atlas claim.

The Chileno vein is a stringer lead of quartz and calcite in highly silicified amphibolite schist, with considerable pyrite often in coarse crystal form.

Clio Mine is on the Mother Lode one-half mile south of Jacksonville. Since the Seventeenth Report of the State Mineralogist, written in 1920, there have been many changes at the property. Late in 1922, the mill and surface plant burned down. A 10-stamp mill with three

Wilfley concentrators and a new Vandercook mercuric cyanide plant of 50 tons capacity have been erected since. Work was formerly carried on through an adit, from which an interior shaft was sunk. The shaft has been raised 205 feet to the surface, and has also been sunk 300 feet and the 700-, 800-, and 900-ft. levels have been opened. The original property, which was a narrow strip along the lode, has been enlarged by the purchase of the Imperial Gold Mines, Bell Boy and West Clio claims and E. R. Bolton property, making a total of 637½ acres. There has been considerable exploratory work from the 600-ft. level down, but comparatively little ore has been milled by the present company.

The shaft is 930 feet deep, on an incline of 67° and has three compartments. Levels are at 218, 306, 361, 473, 565, 700, 800 and 900 feet. There has been a total of 1100 feet of drifting on 218 (adit) level, and 350 feet of drifting on 473-ft. level, of which 200 feet is caved. Of 480 feet of drifting on the 565-ft. level, 200 feet is new work. The 700-ft. level is drifted 300 feet, the 800-ft. level, 225 feet and 900-ft. level has been crosscut for 313 feet east.

The vein consists of quartz stringers and altered amphibolite schist, now a dolomitic sulphide ore, carrying 3% to 5% of pyrite. It has a maximum width of 40 feet but averages 8 to 10 feet. The foot-wall is swelling serpentine with a heavy gouge and the hanging wall is the altered amphibolite schist. The ore is generally low grade, running from $4 to $6 a ton, with low grade concentrate. The property was idle the latter half of 1927, but resumption of work was planned. The deepest stoping was for a length of 160 feet and width of eight feet on the 800-ft. level.

Crystalline Mine, on the Mother Lode north of the Harvard and a mile west of Jamestown, was unwatered and prospected in 1922 and 1923 by Tonopah Mining Company of Nevada. The steam hoist was converted to use electric power and a new headframe was built. The old workings had included a shaft 600 feet deep and levels at 283 and 593 feet, with considerable drifting. Tonopah Mining Company drove the lower level north along the course of the lode the entire length of the property, and to a point beneath the old Alabama shaft. Their option was abandoned late in 1923.

The claims are along the contact of serpentine and Calaveras (Carboniferous) schist and there has been widely dispersed alteration and feeble mineralization.

Dutch-App Group comprises Dutch and Sweeney Mines and millsites, App and Heslep Mines and millsites and Hitchcock Mine, in Secs. 22, 23 T. 1 N., R. 14 E., at Quartz Mountain two miles south of Jamestown. In January, 1928, they were advertised for sale under a deed of trust held by Wells Fargo Bank-Union Trust Company of San Francisco.

The App Mine was worked from 1856 until about 1890, when a depth of 800 feet had been reached, and again from 1893 at intervals until 1911 when another shaft had reached an inclined depth of 1340 feet. From 1915 until 1920 it was prospected and some ore taken out through the lower levels of the adjacent Dutch shaft. The early operations were on a small scale and contemporaneous reports stated that for 12 years the ore averaged $14 a ton. In later years, there was a

60-stamp mill and ore was stoped for a width of 30 feet or more. This was on the footwall vein on the west side of the 'bull quartz' vein. The production of the App is reported to have been about $6,500,000. The ore as mined in the later operations was low grade. Levels were opened at intervals of 100 feet from the new shaft and drifts were run north, the maximum distance being 1240 feet on the 1300-ft. level.

The Heslep Mine was worked previous to 1912 through a shaft 500 feet deep. In that year a cave occurred and 300 feet on the north end was lost. In 1923, J. A. Keyes and associate obtained a lease on the part of the mine above the 300-ft. level. They installed 12 stamps and milled ore for about two years, and are believed to have made a good profit. The Heslep vein outcrop was well defined but in depth it broke into stringers and bunches of quartz. The later work by Keyes was on an ore-shoot reported 260 feet long by six feet wide in the Whitford vein, lying between the Heslep and 'bull quartz' veins.

The Dutch Mine was worked at intervals from early days, and on a small scale. In 1893, larger scale operations were started and continued, with a few short interruptions, until April, 1920. The principal operations were carried on by Dutch Consolidated Mining Company, followed by Dutch-Sweeney Mining Company and finally by Pacific Coast Gold Mines Corporation. The Dutch shaft was sunk to a depth of 1867 feet by the first two companies and most of the production was made by them. The ore was low grade, on the average. A total of 646,000 tons is stated to have yielded $2,500,000, but the entire output is not known. The operations up to 1915 were carried on at low cost, the total operating cost being as low as $2.30 a ton, but costs more than doubled in the period 1915 to 1920 under the last named company. That company sank the Dutch shaft from 1867 to 2350 feet inclined (2070 feet vertical) depth and did about 17,000 feet of new development and exploration work on the App and Heslep veins, on the 1350, 1500, 1650, 2050 and 2300-ft. levels. The 1500-ft. level was the principal one, and was extended 1800 feet. Ore was mined and milled from the 1500, 2050 and 2300-ft levels. The levels were run into the App and Heslep claims south of the Dutch.

The Mother Lode, as it passes through this group of claims, consists of a series of veins with a total width varying from 40 feet on the north to 300 feet at the south, forming at Quartz Mountain the central part of a hill 250 feet high. The lode system is composed of quartz lenses and stringers, included fragments of wall rock, serpentine, dikes, mariposite and ankerite. The various veins in the system are: West, App or Footwall, Middle, Heslep, Whitford (in Heslep claim), Bull Quartz, and Knox & Boyle veins. The various veins may pinch and form lenses or break into stringers, and are not all continuous throughout the group of claims. The App (footwall) vein was principally worked in that mine, the Heslep and Whitford in the Heslep Mine, and the App, Middle and Heslep veins in the Dutch. The lode lies in the Calaveras (Carboniferous) slaty schists with altered greenstone (metaandesite) and serpentine on the footwall and amphibolite schist on the hanging wall.

The ore in later operations was in the form of stringer leads and mineralized schist. The Middle and Heslep veins come within five to ten feet of each other above the 1500-ft. level, and in the App working were stoped together, 30 to 40 feet wide. In the Dutch, between

600 and 800 feet in depth, ore was stoped 60 feet wide and 250 feet long. Ore shoots are said to have crossed the lode diagonally from the footwall to hanging wall and pitched north. The schist ore handled by the last company gave 8% to 10% of concentrate, worth $40 a ton. Ore shoots 10 to 15 feet wide and 200 to 300 feet long were mined. The general average of ore developed and mined by Pacific Coast Gold Mines Corporation was about $5 a ton, but assays varied from $1 to $11 a ton. This company erected a costly reduction plant and mined and milled ore at the rate of 3500 tons a month for some time.

The ore treatment was as follows when the mill was visited when in operation late in 1919: Ore from shaft bins was broken to 3-inch size in gyratory crusher under the bins, and conveyed to mill bins from which it was fed to two Hardinge mills, grinding to 80 mesh. Pulp passed over plates to amalgamate any coarse free gold; classified, fines elevated and sent over two sets of three plates each, for further amalgamation of gold, then sent to a 16-cell Minerals Separation flotation machine. Flotation concentrate from first eight cells was cleaned on two Wilfley tables and from last eight cells was returned to first eight cells. Flotation tailing was sent to a K. and K. flotation machine, from which the concentrate went to a Dorr thickener, diaphragm pump and Oliver filter and was mixed with the concentrate from Wilfley tables for shipment. For flotation, a mixture of pine oil, water-gas tar, stove oil and beechwood creosote was used. A recovery of 90% to 92% was claimed.

The cost of operation was too high to permit a profit on the grade of ore developed, and as costs did not decrease after the war as anticipated, and as the expected gold bonus legislation was not enacted, work was stopped.

Eagle Shawmut Mine, on the Mother Lode near Jacksonville, has been the principal gold producer of the county in recent years. The mine and mill have been described in considerable detail in our past reports (Report XVII, page 479, and Report XVIII, pages 748–750). Belmont Shawmut Mining Company, lessee of the property for many years, quit work in November, 1923, and turned the mine back to the owners in June, 1924. It was subsequently sold to J. D. McCarty who is engaged in milling pillars and other small lots of ore, with the prospect of a complete shut-down soon. The Belmont Shawmut Mining Company mined a large tonnage of ore and tried various methods of milling but the increase of costs during and after the war absorbed all the profits that would have been possible under former conditions on such low and medium-grade ore. The total production of the property has been over $5,000,000.

The ore deposit at this mine occurs in a broad fracture zone which is filled with quartz stringers and dolomite on the hanging wall of a dike which is composed principally of basic feldspars and is coarsely crystalline. The ore here is always accompanied by a massive outcrop of 'bull quartz.'

The ore bearing formations at the surface are at the east side of the complex of Mariposa (Jurassic) rocks, consisting of slate beds, often closely folded and intruded by many small dikes, some showing at the surface in the axes of the folds of slate. The ore lies close to the

contact of the Mariposa beds with a strip of Calaveras formation which is scarcely 100 feet wide at the south end of the property and consists of black and brown slaty-schist, with small lenses of limestone followed on the east by amphibolite schist.

Four types of ore were distinguished by O. McCraney in the later work. They were banded quartz, impregnated schist, dark and light sulphide ores. The principal ore in depth was the dolomite-sulphide ore, occurring in well-defined overlapping lenses 8 feet to 30 feet wide. The vein rolls, and the ore was in the crests of the anticlines. The sulphide content averaged 7%, and was even higher in the dolomite-sulphide ore, which was first encountered on the 17th level, and which became so important a part of the output from there down as to influence the method of treatment. There is a heavy gouge on the footwall side of vein which is six feet wide at the surface and is in contact with the vein between 1100 and 1400 feet in depth, but below is separated from the vein. Where cut in the workings it swelled excessively. Typical cross-sections of the formation at No. 3 and No. 18 levels showed practically the same sequence, with the 'bull quartz' or 'talc' on the footwall followed going toward the hanging wall by dolomite six to eight feet wide, assaying high in gold, at times, but generally low or medium grade, then a stratum of limestone, three to 11 feet wide, which is separated from the amphibolite schist of the hanging wall by 15 feet of black slate (Calaveras formation). Stopes were generally not over 200 feet long. Faults across the course of the lode bound the deposit on both ends, displacing the vein from east to west, looking south; but no important orebodies have been found on either adjoining property. The ore generally averaged from $4 to $4.50 a ton in later years, though at many times better grades were mined, and in the earlier operations ore rich in free gold was found.

The mine was worked through three inclined shafts, the deepest an internal shaft, with an inclined depth of 3213 feet at the 21st level. Later work was through this shaft, reached through a crosscut tunnel 1060 feet long, 450 feet on the dip below outcrop. This shaft was on the vein at an angle of 65° to 68° to between the 11th and 12th levels, then on an angle of 65°, entering the hanging wall and being about 100 feet from the vein on the lower levels. These levels were numbered 16 to 21 and were 200 feet apart. About six miles of drifts were run, most of them north of the shaft.

Many systems of ore reduction have been used at this mine. At first, regulation stamp-milling and plate amalgamation were used. Then a chlorination plant was installed and operated until the Belmont Shawmut Mining Company took the property. The percentage of sulphides (principally pyrite) increased with depth and the proportion of free gold that could be amalgamated decreased. This company installed Jones-Belmont flotation cells and made two grades of concentrate, one on the vanners and one with the cells. These at first were shipped for smelting, but they were usually low grade and shipment and smelter charges were high and smelter specifications quite exacting, so that experiments were carried on to find the best way of extracting the gold at the property.

In the course of this work, it was found that the oil-floated concentrate responded better to cyanide treatment than the table concentrate.

Extended use of the flotation cells also showed that while flotation gave a satisfactory recovery, it was more expensive than the grade of ore justified. The flotation cells were therefore discarded. Sixty stamps were used to crush ore to 18-mesh without amalgamation in batteries or on plates. The pulp was first concentrated on 8 Butchart tables. Table tailing was sent through a Dorr thickener and the thickened feed was concentrated on 16 Frue vanners. The original concentrate from the Butchart tables and the concentrate from the Frue vanners were then ground to minus 200-mesh in a 5 ft. by 18 ft. tube mill to which 8 lb. to 10 lb. of California crude oil was added, per ton of concentrate. The finely ground concentrate was then thickened and cyanided in six 14 ft. by 14 ft. Devereux agitators, and solution sent to precipitation tanks. No battery nor plate amalgamation of gold was considered necessary as the free gold in the sulphide ore was small in amount and finely divided.

Experimental Mine is a mile and a half north of Columbia on the south side of North Fork of Stanislaus River. There are three unpatented lode claims, a millsite and a patented placer claim, giving 2000 feet along the strike. The present stock company, a Nevada corporation called Experimental Mining Company, which has the property under lease and option, has consolidated with it the John Royal quartz claim, adjoining.

The vein was discovered six feet below the surface in the course of placer mining. The first mill, of eight stamps with square wooden stems, was built in 1854. The vein was worked intermittently from 1854 to 1904 and since 1904 the property has been active on a small scale most of the time.

The strike of vein is N. 20° W. and it dips 40° E. The hanging wall is hard dolomitic limestone full of caverns, many of which contain water and mud, and the footwall is limestone and a series of decomposed dioritic dikes, which strike across the course of vein and dip steeply. Ore shoots appear to make at the junctions of these dikes with the vein. The average width of vein in the ore shoots is $2\frac{1}{2}$ to $3\frac{1}{2}$ feet and it is reported to maintain this width in the bottom. The rich ore near the surface was free gold associated with azurite; in depth, it carries free gold, pyrite, galena and chalcopyrite.

The shaft was nearly 400 feet deep, on the dip of vein, with six levels, previous to 1924. A drain tunnel had also been run as a crosscut 2800 feet, and although it was still 300 feet from the vein, it had drained the workings to within 75 feet of the bottom because of the cavernous nature of the limestone. No figure of the total production can be obtained, but Thomas Conlin states that in four seasons (using water power, which was available only part of the year) $55,000 was produced. This was between 1906 and 1909. Since then to 1921, the output paid expenses. In April, 1924, United Mines Company of California (M. M. Van Wyck in control) began work. The drain tunnel was cleared and extended, cutting the Shaft and Cellar ore shoots and extending 100 feet south of the shaft bottom. These ore shoots proved disappointing on this level. A winze was sunk 100 feet on the Cellar shoot and drifts were run, opening the vein for 120 feet. This gave such encouraging results that electric power was brought in

and a good hoist and compressor installed. The winze was sunk 86 feet deeper, and a second level started at a depth of 150 feet. The total output from these winze workings, most of it from the first 100 feet of winze and the first level, was $43,850. This company also connected the drain tunnel level with the old shaft workings 230 feet above. They quit in November, 1926, and other lessees continued work until July, 1927. Another winze was sunk 60 feet deep from the drain tunnel on the shaft ore shoot, which is 300 feet north of the Cellar shoot. The reported output of this work was $11,000 of which $10,000 came from the second winze workings, where a drift and raise were each run 40 feet. In July, 1927, the hoist and compressor were removed, but the present lessees have lately begun work with 15 men and are deepening the Cellar winze. Considerable water has been encountered in sinking this.

There is a 5-stamp mill and other equipment at the tunnel portal and a 3-stamp mill and old water-power hoist at the shaft collar.

Garfield prospect is east of the Grizzly and north of the Starr King and is about two miles from Tuolumne. It was worked up to 1914 by adits, producing about 800 tons of $7 ore from above an adit which reached a depth of 75 feet below the outcrop. Other adits were also driven. In 1917 or 1918, a shaft was sunk 250 feet below the former adit level and a drift was run 1200 feet on the fissure, which there carried about one foot of gouge, reported to assay $4 a ton. One adit was also run 800 feet. No payable ore was developed in either case. The Garfield claim is patented and three unpatented claims were held also. There is a mill of ten 1050-lb. stamps.

Harriman Mine. Harriman Mining and Milling Company, owners, 1106 Tribune Tower, Oakland. L. A. Lessman, president; L. W. Jefferson, secretary-treasurer.

It is on the Mother Lode a mile and a half south of Jacksonville. It contains three patented claims, named M. B., Sonora and Hayes, and the Willieta claim is under option, giving a total length of about a mile. At this place, the Mariposa slates are only about 1500 feet in width and are flanked on the east by serpentine and the Calaveras formation with intrusive dikes of diabase. The principal workings are at the contact with serpentine on the footwall.

There are two shafts, both on the M. B. claim. No. 1 or north shaft is 500 feet deep on 61° incline, with levels at 200, 350 and 500 feet inclined depth. This shaft has two compartments to 350 feet in depth and the balance has three compartments. Drifts have been run 280 feet south and 150 feet north on the 350-ft. level. The south drift is on the vein, averaging probably eight feet wide, one crosscut showing 35 feet in width which is reported to average $4 a ton. This ore shoot is believed to be 100 feet long. It has a soft, black serpentine footwall and a hard diabase hanging wall which has been crosscut for 70 feet. The south drift on the 200-ft. level is 570 feet long, connecting with No. 2 shaft. The 500-ft. level was still under water and inaccessible at time of visit in October, 1927. The entire mineralized formation at the property is 180 feet wide, of which the portion next the serpentine is the footwall or 'bull quartz' vein. In the south shaft workings at 120-ft. level, which were open in 1921, the diabase dike and

later grey dikes run parallel. A zone of stringers in the diabase carried free gold where they ran to and were cut off by the grey dikes. The amount of such ore was small. A crosscut was run on that level 116 feet east into the footwall.

George Z. Bertschy, the present superintendent, reports finding a good prospect on the Sonora claim a little east of the No. 1 shaft and will crosscut from the 500-ft. level to see if this extends to that level. The prospect is on the hanging wall of the diabase.

The property is equipped with electric hoist, air compressor (340 cu. ft. free air p. m.) and 10-stamp Straub mill and one concentrator. The mill capacity is 12½ tons daily to 35 mesh.

Harvard Mine is a mile southwest of Jamestown on the Mother Lode. It was discovered in 1850 and worked at intervals until October, 1917, since which time the mill and hoist have been dismantled and the mine has lain idle. The property comprises the McCann, Mooney, Trio and Sobrante mining claims and Mooney millsite, and covers about 5000 feet. The Trio and Mooney claims, when worked at shallow depths in the early days, produced ore carrying about $4.75 a ton, and the bulk of ore produced has been low grade, although one narrow vein at the serpentine contact in the south workings produced a small amount of very rich ore.

The lode here has a serpentine footwall and Calaveras slate and schist hanging wall. Most of the ore in later operations was mineralized schist and stringers of quartz cutting the schist. Several ore shoots averaging 200 feet long by six feet wide were worked up to the time of the war. An operating cost of about $2 a ton was claimed in 1914 with 60 stamps crushing about 300 tons of ore daily, and with a total crew of 115 men. After the war started, costs rose and higher grade ore had to be sought. Shortly before closing, ore of fair grade was developed on the north on the 1850-ft. level, but at quite a distance from the shaft, and apparently did not offer sufficient incentive to continue operation.

The mine was opened through two shafts 1000 feet part. No. 1, the north shaft, was 700 feet deep and No. 2, the main working shaft in later years, was perpendicular for 700 feet, then on an incline of 58° to a depth of 1850 feet. Levels were run at intervals of 150 feet in the lower part of the mine.

Usual Mother Lode practice was followed in milling. The stamps weighed 1200 lb. each and crushed ore to pass either 40-mesh or 20-mesh screen. Concentrate was saved on Johnson vanners. It was low grade, running $30 to $35 a ton, and consisting almost entirely of pyrite. The recovery was 85% to 90% of mill head assay value. The total reported output of the mine was about $2,500,000.

Lucky Strike Prospect. J. D. Thomas, Confidence, et al., owners. There are six claims on the east side of North Fork of Tuolumne River three miles by steep road from Confidence. Lucky Strike claim is the site of most of the work done.

There is an adit 120 feet long on a vein striking N. 35° to N. 60° E. and dipping 83° NW. It has a maximum width of 4½ feet. A winze 10 feet deep is sunk at the face of adit. A short distance west an inclined shaft has been sunk 50 feet and a level run 70 feet (now under

water) on a flat vein crossing the other. The first mentioned vein is white quartz carrying patches of zincblende, pyrite and a little galena. It looks promising but assays so far have varied from $1 to $7.90 a ton. The second vein is a small one showing some pyrite. There is a small hoist at the shaft with two auto engines for power.

On the adjoining hillside on these claims there are several other veins in the granodiorite. Some of these pan well in gold, but have not been prospected.

Mayflower Prospect contains three unpatented claims two miles southeast of Confidence on the west side of the canyon of North Fork of Tuolumne River. W. T. Barrett, Confidence, is the owner and California Barrett Gold Mining Company, Oakland, has a lease and option to purchase.

There is an old drift 74 feet long on the vein, a crosscut of 30 feet and a winze 12 feet on a vein striking northeast reported 40 inches wide, but this is partly inaccessible. At a point 100 feet lower vertically and at an elevation of 3080 feet, an adit had been run 140 feet at time of visit, crosscutting toward the vein. The country rock is granodiorite, and where the adit runs there has been a partial differentiation of the lighter minerals, especially quartz, but it shows considerable hornblende near the face, and a small quartz vein, so far unprospected. It was not expected to cut the vein found above for about 100 feet farther.

There is a 16-h.p. gas engine and 8″ by 6″ vertical compressor at the lower adit. Two men are employed.

Morning Glory Mine is 2.7 miles by steep road from Confidence, and at an elevation of 3010 feet just east of North Fork of Tuolumne River. C. Layman and J. A. King are working it. There are five claims in the property, but most of the work is on the Morning Glory claim.

The vein strikes N. 20° W. and dips about 24° east. It varies from six inches to two feet wide and carries galena, pyrite and free gold in ribbon quartz. In the mine workings it is enclosed in a greenish dike which intrudes the granodiorite country rock.

A shaft follows the vein on its dip for 140 feet in the hard dike rock. Drifts have been run short distances north and south from the shaft, but only a small tonnage has been mined and milled. There is a compressor and a small pump, operated by water power.

Phoenix Mine. Owner, Phoenix Mining Company. B. A. Whittaker, president, Tuolumne. It comprises two claims, the Phoenix and Central, three miles southeast of Tuolumne near the Providence mine. The claims cover 1500 feet in length on the vein.

The company began work in 1921 and was incorporated in 1924. They claim to have spent $22,000 in development work. An inclined shaft has been sunk and levels were turned at 170 and 265 feet inclined depth. The first level was drifted 165 feet south and the second 411 feet south and 80 feet north. In the latter, it is claimed that the vein averages six to eight feet wide and shows payable ore for 220 feet as proved in four winzes, but this could not be checked as the property is idle and workings could not be visited. The company is seeking further funds to deepen the shaft and open another level.

Providence Mine is 2½ miles southeast of Tuolumne. It was worked on a small scale prior to 1896 and was described in the Fourteenth Report of the State Mineralogist. It was one of the large producers of the East Belt, but has lain idle since 1917, the principal period of production having been between 1897 and 1908.

It was worked through an inclined shaft 1300 feet deep on an incline of 45° and the vein was drifted for a maximum distance of 1050 feet to the 1100-ft. level, the larger part of work being north of the shaft. The ore shoots opened on the hanging wall vein were stoped from the 1100-ft. level to the 700-ft. level, and on the footwall vein ore was stoped from the 700-ft. level to the surface. In the later operations, ore is reported to have been worth $10 to $15 a ton. It is on the Eureka-Dead Horse lode and carried free gold, pyrite and galena. A 10-stamp mill was operated. The reported gross production was $700,000.

Starr King Mine is two miles in an air-line or seven miles by road from Tuolumne and contains the Starr King and Sherman patented claims, the American (unpatented) and a millsite. The first two were worked from early days. From 1886 until 1906 the Sherman Mining Company operated them. The Starr King Development Company put up a 5-stamp mill in 1906 which burned down after running three days. It then lay idle until 1911, when it was purchased by R. C. Kennedy, who put up a new 5-stamp mill and other machinery and worked it until the end of 1916, since when the Starr King Mine, Inc., was formed but has done little, if any, work. A total production of $100,000 has been claimed, during 30 years of occasional small operations.

The vein occurs in the Calaveras formations (Carboniferous) composed of slate and mica schist with dikes and some limestone. The strike is generally north and dip 30° to 50° east and the ore formation is irregular and richest at the junctions of joints. The shaft is 510 feet deep, following the vein at an angle of 30° to 60° and the vein has been explored for 400 feet along the strike, with five levels, most of the drifting being north of the shaft. The vein varies in width from a narrow seam to 36 inches. The only reliable way to determine the value of ore is said to be by mill runs.

According to a report by Robert Hawxhurst, Jr., a mill run of 100 tons gave an average of $8.67 a ton on the plates and a loss of $2.30 a ton in the tailing, from three ore shoots, one south and two north of the shaft. Another mill test by Alexander Hamilton indicated $25.40 a ton from ore taken out on the 500-ft. level.

The property is equipped with five 1150-lb. stamps, one concentrator, a 25-h.p. electric hoist, compressor, tools and necessary buildings with accommodations for a crew of 10 men.

United Mines (Grizzly, Lady Washington, Dead Horse, Eureka, New Albany). The holdings consist of nine patented claims. The last regular milling operations were in 1914, when the New Albany vein, east of and parallel to the Dead Horse vein, was being worked. The workings on these claims were extensive, including the Dead Horse shaft reported 2100 feet deep on an incline of 50°, New Albany shaft 1020 feet deep on the incline, Grizzly shaft 1000 feet deep, and Lady Washington adit, 3300 feet long. This adit was a crosscut for 2400

feet, cutting the Dead Horse vein at an inclined depth of 1165 feet and thence running as a drift on the vein for over 900 feet northwest. The last work, in 1919–1921, was done by the Grizzly Mining Company and consisted of extending the last-named adit level along the vein, also in sinking the Dead Horse shaft 300 feet and crosscutting 180 feet in a search for ore, which was unsuccessful. The Dead Horse vein was stoped to the 1400-ft. level and the New Albany from 700-ft. level to surface.

The veins occur in the contact zone between the Calaveras mica schist on east and granodiorite on west, but both walls of the Dead Horse vein are granodiorite in the later workings to the northwest. The footwall schist near the vein was soft and black. This vein was one to five feet wide and three ore shoots were worked, the best ore being reported where a granodiorite dike came in contact with the vein. It is said this contact seldom extended for more than 60 feet at a time, but these old workings were inaccessible when the mine was visited during the last operations.

Two ore shoots were worked in the New Albany, where the ore is reported at the intersection of cross diorite dikes with the vein. The ore in both properties was of good grade carrying coarse and fine free gold and 1½ to 2% sulphides averaging $70 a ton in value. The principal operations were under the control of Alvinza Hayward, who never gave out information about the results obtained, but the estimated production of the Dead Horse-Eureka group was $1,500,000 and of the New Albany, $200,000.

Wise Claim adjoins the Chileno on Jackass Hill. It is being worked by S. J. Davies, one of the owners, who mines and crushes small lots of ore. It is developed by two adits, 100 feet and 600 feet long, respectively, on the stringers and small veins in the amphibolite schist, characteristic of this district. Davies lately put up a mill of three 600-lb. stamps for which power is furnished by a Ford automobile engine. The mill has no rock breaker nor concentrator, and crushes two tons in eight hours through 40-mesh screen.

TABLE OF QUARTZ MINES AND PROSPECTS, TUOLUMNE COUNTY.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Abbie L.	30	1 S.	16 E.	M. W. Hilliard, Big Oak Flat	2700	10	XIV, p. 136.
Ajax	34, 35	1 N.	15 E.	Mrs. Hulda Seiler, 108 Marin St., San Rafael		42	XIII, p. 472.
Alabama	9	1 N.	14 E.	Joseph D. Redding, Crocker Bldg., San Francisco	1650	19	X, p. 53, 741-742; XII, p. 298; XIII, p. 472; XIV, p. 136; XVIII, p. 99; XIX, pp. 19, 74, 145; XX, p. 19.
Alameda	5	1 N.	14 E.	Charles Fitzgerald, Jamestown et al	1600	20	X, p. 55; XI, p. 508; XII, p. 299; XIII, p. 473; XIV, p. 136; XX, p. 12.
Albion Cons.	2	1 S.	14 E.	Albion Cons. G. Mining Co., c/o M. McCormick, 1432 No. El Dorado St., Stockton		67	
Allen							XIII, p. 473.
Alexander							XIII, p. 473.
Alhambra							XIII, p. 473.
Alta and Antelope							X, p. 757; XIII, p. 473.
Altadena and Kearsage	9, 10	2 N.	15 E.	M. H. Ellis, Columbia		80	
Altamont	32	2 N.	14 E.	Mrs. Emelia Lawson, 5641 Miles Ave., Oakland			XIII, p. 473.
Alvarado							XIII, p. 473.
Anderson G. Mining Co.	31	1 N.	15 E.	Anderson G. Mining Co., c/o Mrs. M. A. Ford Gilbert, 905 N. Stockton St., Stockton		160	
Anti-Chinese	32	2 N.	14 E.	Heirs of L. T. Slonicker, c/o Mrs. A. S. Slonicker, 475 22d Ave., San Francisco		16	
App	22	1 N.	14 E.	c/o C. H. Segerstrom, Sonora	1680	40	VIII, pp. 660-661; XII, p. 299; XIII, p. 473; XIV, pp. 136-137; XVII, pp. 482-483; XIX, p. 144; Bull. 18, pp. 130-131; See also Dutch.
Aramenta							See Garfield-Virginia.
Arbona	32	2 N.	14 E.	Calmas Mining Co., c/o C. M. Swerer, R. 1., Sonora	1400	25	XIII, p. 473; XIV, p. 137; Bull. 18, p. 129
Argall							XIII, p. 473.
Argentine							See Argentum.
Argentum	28, 29	3 N.	15 E.	Argentum G. and S. Mining Co., c/o J. Henry Senger, 1321 Bay View Place, Berkeley			XII, p. 299; XIII, p. 473; XIV, p. 137.
Atlas and Soldiers Gulch	30	2 N.	14 E.	Mark Twain Mining Co., 511 Bank of Italy Bldg., Oakland		27	XIII, pp. 473-474; XIV, pp. 137-138.
Austrian							See Bald Mountain.
W. Ext. of Austrian	24, 25	2 N.	14 E.	John Ferguson, Masonic Club, San Francisco		3	

Badger	13	1 N.	14 E.	Badger Qtz. Mine, c/o Alvin I. Ellis, 558-11th Ave. San Francisco		21	XIII, p. 474.
Baer	31	2 N.	15 E.	J. E. Baer, Sonora		8	
		2 N.	14 E.				
Badger	18	1 N.	14 E.	Badger Qtz. Mine, c/o Catherine A. Ellis, 480 10th Ave., San Francisco			XI, pp. 508-509; XIII, p. 474.
Bald Mountain	25	2 N.	14 E.	Heirs of Birney and Monroe, c/o L. Fontana, 1015 No. Center St., Stockton			XIII, p. 474
Banner	29	1 S.	16 E.	Chas. Harper, C. E. Watson, Big Oak Flat	3000	20	XIV, p. 138.
Beckwith & Saunders	36	2 N.	12 E.				XIII, p. 474
Belcher							VIII, p. 672; XII, p. 299.
Bell	30, 31	2 N.	14 E.	Sutton & Rowe, c/o Fred Sutton, Sonora	1500	20	XIII, p. 474; XIV, p. 138.
Bellevue							See Hyde.
Belmont-Shawmut	11, 12	1 S.	15 E.	(See Eagle-Shawmut)		2000	XVII, pp. 479-481; XVIII, pp. 99, 748-750; XIX, p. 19; Pre. Rep. No. 8, p. 39; XX, p. 19.
Belmont	25	2 N.	14 E.	G. E. Garrett, Sonora	2180	10	XIV, p. 138; XX, p. 19.
Benjamin Harrison							XIII, p. 474.
Bicknell	29, 32	1 S.	16 E.	Adela Smith and Louisa A. Cobden, c/o Mrs. L. A. Cobden, Groveland	2850	20	XIV, p. 138.
Big Bonanza							See Bonanza.
Big Casino							See Mack.
Big Chunk	7	1 S.	15 E.	Est. T. F. McGovern, c/o F. R. McGovern, Santa Rosa		20	
Big Oak Flat No. 1	30	1 S.	16 E.	Central Land Co., c/o Ernest Caplinger, Big Oak Flat		15	XIII, p. 474.
Birney							See Hammilfield.
Blackfoot & Slide Hill	18	1 S.	15 E.	Now part of Clio		36	
Black Hawk	35	2 N.	15 E.	A. A. Irish, May Frances Craig, 405 Grosse Bldg. Los Angeles	2600	60	XIV, p. 138.
Black Hawk	21, 28	1 S.	15 E.	Helen L. Tallant, c/o Tallant & Tallant, 402 Mutual Savings Bank Bldg., 315 Montgomery St., San Francisco		21	
Black Oak, Live Oak, White Oak, Carra	1	1 N.	15 E.	Black Oak Mines Co., Soulsbyville	2850	38	VIII, pp. 665-666; X, pp. 744-746; XI, p. 501; XII, p. 299; XIII, p. 474; XIV, pp. 138-140; Bull. 18, pp. 137-138.
	36	2 N.	15 E.				
Blue Eagle	3, 4	1 S.	18 E.	Eleanor Mining Co., 11 Romo St., San Francisco	4000	40	Field Report.
Bluehead	28	2 N.	16 E.	Mrs. E. Fowles, Arastraville	3100	30	XIV, p. 140.
Blue & White Star	31	1 N.	16 E.	J. Hienberg, Charles F. Stucki, Tuolumne	1200	40	XIV, p. 140.
Boitano	18	1 S.	16 E.	A. Boitano, Deer Flat	2400	30	XIV, p. 140; XVII, p. 485.
Boitano Ranch	Big	Oak	Flat	Harvard Mining & Milling Co., c/o George S. Meyer, 329 St. Chas. St., Elgin, Ill.			

*Due to various legal complications which may arise regarding ownership of mining claims, we do not vouch for absolute correctness of this column. The names are mostly those appearing on the tax rolls. To save space, frequently only one of several owners is listed.

TABLE OF QUARTZ MINES AND PROSPECTS, TUOLUMNE COUNTY—Continued.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Bonanza	36	2 N.	14 E.	Roscoe Oliver, Sonora	1800	14	VIII, pp. 652-654; IX, p. 37; X, p. 736; XI, pp. 511-513; XII, pp. 299-300; XIII, p. 475; XIV, p. 141; XVIII, p. 99; Pre. Rep. 8, p. 39.
Bonita	9	1 N.	16 E.	Wm. Angus & Chas. Neal, c/o G. L. Breese & Co., Kohl Bldg., San Francisco		11	XIII, p. 475; XIV, p. 140; XVII, p. 485.
Boston							See Philadelphia
Bourne	29	1 S.	16 E.	Henry F. Heiden, Groveland			
Bown	25	2 N.	13 E.	R. Minor, 1105 Sherman St., Alameda			XIV, p. 141; Bull. 18, p. 129.
Breknell	29, 31	1 S.	16 E.	Mrs. E. Raggio, Big Oak Flat		20	
Brown Bird	2	1 S.	14 E.	Wm. G. Fitzgerald, Jamestown		20	
Buchanan & Lookout	26, 27	1 N.	16 E.	Mrs. Alfreda Davis Wright, 648 Taylor Ave., Alameda	3000	20	VIII, pp. 666-669; X, pp. 752-755; XI, pp. 492-496; XII, p. 300; XIII, p. 475; XIV, p. 141.
Buckeye							See Seminole.
Buckhorn							XVII, p. 485; Pre. Rep. 8, p. 39.
Buena Vista	29, 31	2 N.	14 E.	Mrs. M. R. Clement, 422 Pacific Ave., Piedmont		22	
Buona Speranza	22	1 S.	15 E.	Mary Ferretti, c/o Mrs. Eugenia Hughes, Chinese Camp	21		
Buzzard's Roost				Vivian and Gerloch, Sonora			XI, p. 506; XIII, p. 475; XIV, p. 141
Cardinelle							XIII, p. 475
Carlin	10, 15	1 N.	14 E.	Jamestown Exploration Co., 32 California St., Stockton	1200	22	XIV, p. 141.
Carlotta Cons	5	1 N.	16 E.	Carlotta G. Mining Co., c/o T. P. Sullivan, 176 Haight St., San Francisco	2600	35	XI, p. 499; XII, p. 300; XIII, p. 475; XIV, p. 141.
	32	2 N.	16 E.				
Carmelita							XIII, p. 475.
Carrie							XIII, p. 475.
Cary							X, p. 748.
Casa Madera (18 unpat. claims also)	24, 13	2 N.	16 E.	Casa Madera G. Mining Syndicate, Humboldt Bank Bldg., San Francisco		35	XIX, p. 144; XX, pp. 19-20.
Central	32	2 N.	16 E.	J. & P. Grazioli, Tuolumne		11	
Champion	30	1 S.	16 E.	Mrs. A. Cumming, c/o D. W. Cumming, 2028 Burbeck, Ave., Richmond		20	

Chance	21	1 S.	15 E.	R. H. Goodwin, 579-25th St., Oakland		17	
Chantreau	7	1 N.	14 E.	F. W. Street, Mrs. M. J. Hagman et al., c/o Mrs. M. J. Hagman, Jamestown		12	
Chaparral	26, 27	1 N.	16 E.	F. A. Wenzel, Sonora		21	XI, p. 496, XII, p. 300; XIII, p. 475; XIV, p. 142.
	35	1 N.	16 E.				
Chileno	30	2 N.	14 E.	Mark Twain Mining Co., a corp., 511 Bank of Italy Bldg., Oakland		16	XIII, pp. 482-483; XIV, p. 142; XVIII, pp. 99-100; XIX, pp. 19, 144-145; Bull. 18, p. 129.
Chimney Rock							XIII, p. 475.
Chlorinda							XI, p. 506.
Clio & Jackson	29	1 S.	16 E.	Chas. F. Harper, Big Oak Flat		40	
Clio	18	1 S.	15 E.	Clio Vindicator Mining Co., Chinese Camp c/o H. Haeuter	900	115	X, p. 47; XIII, pp. 475-476; XIV, p. 142; XVII, p. 481; XVIII, p. 100; XIX p. 19; XX, p. 20, 182; Pre. Rep. 8, p 39.
Cloudman				See Erin-go-bragh			XIII, p. 476.
Coffee-Mill							XIII, p. 476.
Colby							XIII, pp. 476, 483.
Columbus	31, 32	2 N.	16 E.	J. J. Cade, c/o A. L. F. Warren, Tax Agt. Cherokee Mines Cons. Inc., 307 Park Bldg., Portland, Ore.	2600	45	XII, p. 301; XIII, p. 476; XIV, p. 142.
Combination	32	2 N.	14 E.	Tuolumne County Bank, c/o C. H. Segerstrom, Sonora		2	XIII, p. 476.
Comstock							XIII, p. 476.
Confidence, Jessie, Edith, Independence, Confidence No. 2, 3	10	2 N.	16 E.	George H. Sexton Estate, c/o A. E. Rome, 716 Call Bldg., San Francisco	4000	70	XI, p. 503; XIII, p. 476; XIV, p. 142; XVII, p. 482; Bull. 18, pp. 136-137
Conlin & Graham							XIII, p. 476; XII, p. 301.
Conrad							XII, pp. 209, 301.
Cons. Eureka				Part of United Mines Group			VIII, pp. 664-665; X, pp. 750-752; XI, p. 498; XII, p. 301; XIII, p. 476; Bull. 18, p. 139.
Consuelo, Fair Play Cons. & Goodenough	16, 9	1 N.	16 E.	Estate of Anna M. Bluett, c/o Ben F. Woolner, Att'y., 1st Nat'l Bank Bldg., Oakland			XII, p. 301; XIII, pp. 476-477; XIV, p. 143.
	36	1 N.	15 E.				
Contact	1	2 S.	15 E.	G. B. Musante, Big Oak Flat		17	
	31	1 S.	16 E.				
Contention	16, 17	3 N.	15 E.	Franco Contention Mining Co., c/o C. O'Shea, Box 123, Jamestown		182	
Cordova	28	2 N.	16 E.	Claire McNee, c/o M. W. McIntosh, 114 Sansome St., San Francisco			

*Ownerships shown in this table are those shown on assessment rolls.

TABLE OF QUARTZ MINES AND PROSPECTS, TUOLUMNE COUNTY—Continued.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Cornucopia No. 1, No. 2, New Eden, Eden No. 2, Mason	1	1 N.	15 E.	Black Oak South Ext. Mining Co., c/o James Mason, 430 California St., San Francisco			
Cosmopolite & Violet	29	1 S.	16 E.	M. C. Merrill, Groveland	3125	39	XI, p. 494; XII, p. 301; XIII, p. 477; XIV, p. 143.
Crown Point							XIII, p. 477.
Criss Cross & Relief	25, 26	1 S.	16 E.	Saul Morris, 202 E. Adam St., Stockton		31	XIII, p. 477.
Crystalline	9	1 N.	14 E.	Cecile Shafer, Jamestown	1500	51	X, p. 742; XIII, pp. 477-479; XIV, p. 143; XVIII, p. 99; XIX, pp. 19, 74, 145; XX, p. 19.
Darrow	5	1 N.	14 E.	J. H. Darrow, Jamestown	1000	20	XII, p. 301; XIII, p. 477; XIV, p. 143.
Dawn	1	1 N.	15 E.	J. J. & R. A. Nicholls, Soulsbyville		20	
Dead Horse				Part of United Mines Group			VIII, pp. 664-665; X, p. 750-752; XI, p. 498
Del Monte	21	1 S.	16 E.	Sierra Gold Mining Co., Arlington Heights, Illinois	2900	16	XIV, p. 143.
Densmore & Young America	4	2 N.	14 E.	Densmore Cons Qtz. Mining Co., c/o Crittenden Hampton, Sonora	1000	40	XIV, pp. 143-144; Bull. 18, pp. 135-136.
Dinsmore	11, 14	22 N.	9 E.				
	22, 23	22 N.	9 E.			960	Pre. Rep. No. 8, p. 38.
Donella	Near Ara	stravil	le	Ben Soulsby, c/o John B. Sivori, Tuolumne, et al.			XII, p. 304; XIII, p. 487; XX, p. 20.
Donovan							See Vulture.
Don Pedro	26	2 S.	14 S.		850		Field Report.
Dorsey							XIII, p. 477.
Draper							See Whitto.
Dreisam	28	2 N.	16 E.	J. E. Conde, Arastraville, et al.	3300	40	XIV, p. 144; Bull. 18, p. 139.
Duffield	28	2 N.	16 E.	Andrew Scanavino, Tuolumne, et al	3150	35	XIII, p. 477; XIV, p. 144.
Duleek No. 1, 2, 3	2	1 S.	16 E.	W. J. Graham, Box 247 St. George, Utah	2700	61	XIV, p. 144.
Dundero							XIII, p. 477.
Dutch	22, 23	1 N.	14 E.	Pacific Coast Gold Mines Corp., c/o C. H. Segerstrom, Sonora	1661	70	X, p. 51; XI, p. 509; XII, p. 302; XIII, p. 477; XIV; pp. 145-146; XVII, p. 482; Bull. 18, p. 130.
Eagle Shawmut	11, 12	1 S.	15 E.	J. D. McCarty, Milton	900	760	X, p. 48; XIII, p. 477; XIV, p. 146; XVII, p. 479; XVIII, pp. 99, 748-750; XIX, p. 19; XX, p. 183; Bull. 18, pp. 132-133.
East Lode							XIII, p. 478.

Edgar							See Dinsmore.
Ella D. & Morning Star	25, 26	3 N.	14 E.	Walter S. Elkins, Columbia		35	
	35, 36	3 N.	14 E.				
Electric & Thunderbolt	5	2 N.	16 E.	G. A. Panchott, Soulsbyville		31	
Erin-Go-Bragh & Cloudman	27	1 N.	14 E.	R. C. Bach, 1133 No. San Joaquin St., Stockton			XIII, p. 478; XX, p. 20.
Etna	30, 31	2 N.	15 E.	Mrs. Mary E. Wolfling, 2461 Park Boulevard, Oakland		6	
Esterbrook							See Hazel Dell
Eureka				J. T. Faxon, Sonora			XII, p. 302; XIII, p. 478; XIV, p. 148.
Eureka				Part of United Mines Group			XIII, p. 480; See Cons. Eureka also.
Eureka & Mississippi	30	1 S.	16 E.	Santa Ana Mining Co., 152 Federal St., Boston, Mass.	2750	60	XII, p. 304; XIII, p. 486; XIV, p. 148.
Excelsior	1	2 N.	16 E.	Excelsior G. Mines, Inc., c/o F. J. Kinghorn, 1940 Post St., San Francisco			
Excelsior	36	3 N.	16 E.	Fred Sutton, Sonora	4300	20	XIII, p. 478; XIV, p. 148.
Experimental	1	2 N.	14 E.	Thos. & John Conlin, Columbia	1820	25	VIII, pp. 658-660; XIV, p. 148; XX, p. 20; Pre. Rep. 8, p. 40.
Fairview							XIII, p. 478.
Fitzgerald	35	1 N.	15 E.	Estate of F. M. Crane, Sonora		21	
Fischer							XIII, p. 478.
Florence				H. Orlands, Tuttletown			XII, p. 302; XIII, p. 478; XIV, p. 148.
Ford							See Page.
Fox, Hudson Calhoun & Ford Group	18	2 N.	14 E.	Victor Dondero & Charles Bloom	2140	50	XIV, p. 148.
Fraction	8	1 S.	15 E.	Andrew McCormick, Stockton		2	
Free Lance	14	1 S.	15 E.	Emma L. Mangante, Sonora		18	
Free Lance, Ext. 4	1, 2	1 S.	15 E.	Mrs. D. W. Berger, Sonora		18	
Gamble							XIII, p. 478.
Gandolfo & Rocca							XX, p. 183.
Garfield	9	1 N.	16 E.	James L. Gibbs, Tuolumne	1850	65	XIV, pp. 148-149; XIII, p. 478; XII, p. 302.
Garfield & Virginia	26, 35	1 N.	16 E.	Estate of J. B. Curtin, c/o Mrs. Lucy Curtin, Sonora		77	
Garrett							See Page.
Gem	16	1 S.	14 E.		1480		XII, p. 302.
Gem	3	2 N.	14 E.	McCormick Co. & Mrs. Nelo Gustaf et al., c/o Andrew McCormick, Stockton	3900	24	VIII, pp. 663-664; XI, p. 506; XII, p. 302; XIV, p. 149.
Gem & Senate	Con	fidence	Dist.	F. M. Wulzen, Confidence			
Genevieve	36	2 N.	15 E.	Genevieve Mining Co., c/o J. J. McDade, 1019 Hearst Bldg., San Francisco			
Georgia							See Seminole.

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TABLE OF QUARTZ MINES AND PROSPECTS, TUOLUMNE COUNTY—Continued.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Georgiana							See Garfield.
Gerrymander Cons.	1	1 N.	14 E.	Gerrymander Cons. Mining Co., c/o John J. McCarthy, Secretary, 365 Bush St., San Francisco		30	
Gladdis							See Argall.
Gladstone	18	1 S.	15 E.	Now part of Clio		18	XI, p. 510; XIII, p. 478; XIV, p. 149.
Gloster							See Providence.
Godfrey							XIII, p. 479.
Gold But							XIII, p. 479.
Golden Crown							VIII, p. 675.
Golden Dam	35	2 N.	15 E.	R. A. Nichols, J. J. Nichols, Soulsbyville	2700	20	Field Report.
Golden Eagle	19	1 S.	16 E.		2900		XIII, p. 479.
Golden Gate	1	1 N.	14 E.	M. McCormick Co., 1432 No. El Dorado St., Stockton, c/o Andrew McCormick	1800		X, pp. 738-740; XI, p. 511; XII, p. 302; XIII, p. 479; XIV, p. 149; Bull. 18, pp. 134-135.
Golden Poppy Mining Co.	17	1 S.	15 E.	Golden Poppy Mining Co., Inc., Freedburger-Blodgett Bldg., Lodi		153	
Golden Nugget	2	1 S.	14 E.	Maud Twist, Tuolumne		19	
Gold Ridge Mining Co.	1, 2	1 S.	14 E.	c/o W. T. Jones, Jamestown		54	
Golden Rule				Part of Jumper			XIII, pp. 479-480.
Golden Rock							XIII, p. 479.
Golden Star	32	2 N.	14 E.		1125		XIII, p. 480.
Golden Treasure							See Hyde.
Golden West	7	2 N.	16 E.	Mary Marsciano, 781 Green St., San Francisco			
Gold Hunter							XIII, p. 479.
Gold Nugget							See Merritt.
Goldwin	16	1 N.	16 E.		2000		Bull. 18, pp. 138-139.
Good Hope	24	2 N.	14 E.	Theodore Schoefer, Jr., Sacramento, ½; Bill Petrovich, 1019 2d St., Sacramento, ½		14	
Good Luck	24	2 N.	14 E.	John Slano, Sonora, et al			
Good Luck, Ophir and Yellow Jacket Claims	Arstraville Dist.			Pacific Expl. Co., c/o W. B. Morris, 3016 E. 29th St., Oakland			
Good Luck M. & M. Co.	12	1 S.	14 E.	Good Luck Mining & M. Co., c/o Frank D. Doe, 16 California St., San Francisco			
Good Shepherd	18	2 N.	16 E.	Garnett T. Barron, Soulsbyville			XIII, p. 480.

Grass Extension	29, 30	2 N.	14 E.	Fred Sutton, Sonora			
Grand Turk	29	2 N.	14 E.	A. W. Stinchfield & F. A. Mitchell, R. F. D. 1, Sonora		20	
Grant							XIII, p. 480.
Gray Eagle							See Santa Ysabel.
Great Sierra							VIII, p. 675.
Green							See Mt. Vernon & Green Cons.
Grey Eagle & Rival	23, 24	3 N.	15 E.	Frances Korbel et al., c/o P. Y. Lewis, Columbia			
Grizzly	9, 4	1 N.	16 E.	Grizzly Mining Co., c/o Horace M. Street, 709 Hobart Bldg., San Francisco	2000	130	XIII, p. 480; XVII, pp. 483-484; Bull. 18, p. 139; See United Mines Group also.
Gross Cons.	29, 30	2 N.	14 E.	Gross-Street Mining Co., c/o E. B. Cushman, 1024 Mills Building, San Francisco			
Gross	29	3 N.	15 E.	F. G. Gross, c/o Mrs. L. E. Larson, 629 South East St., Stockton, California		12	XIII, p. 480.
Ham & Birney, Hart & Jacobs	4	2 N.	15 E.	Hamilfield Mining Co., c/o H. M. A. Miller, Kohl Bldg., 341 Montgomery St., San Francisco		41	
Hamilfield				See Ham & Birney			XIII, pp. 480-481.
Hancock							XIII, p. 481.
Happy Jack	8	2 N.	16 E.	Mrs. C. Skaggs, 108 Liberty St., San Francisco		20	
Hard Rock	9, 10	2 N.	15 E.	Florence M. Davis, 521 Pacheco St., San Francisco		30	
Harriman	19, 30	1 S.	15 E.	Harriman G. Mining & Milling Co., c/o L. W. Jefferson, Tribune Tower, Oakland	900	55	XVII, p. 485; XVIII, p. 100; XX, p. 20; Pre. Rep. 8, p. 40.
Hawk, May, Hartman	14	2 N.	16 E.	Phoenix Lake G. Mining Co., c/o S. F. Milling Co., 7th and Berry Sts., San Francisco		54	
Harris							See Crystalline.
Harvard	16	1 N.	14 E.	Thomas A. Ferguson, 615 Kohl Bldg., San Francisco	1390		X, p. 53; XIII, pp. 485, 493; XIV, pp. 149-151, 164; Bull. 18, p. 130.
Hayes							XIII, p. 481.
Hazel Dell	35, 36	3 N.	15 E.	Hales & Symons, Sonora		104	XIII, p. 481; XIV, pp. 151-152.
Hector							XIII, p. 481
Henrietta				C. F. Haslan, Sonora			XII, p. 302; XIII, p. 481; XIV, p. 152.
Heslep	22	1 N.	14 E.	See Dutch			VIII, p. 660; XII, p. 299; XIII, p. 473; XIV, p. 136; XIX, p. 144; XX, p. 20.
Hibbing							XIII, p. 481.
Hidden Treasure							XIII, p. 481; XVIII, p. 101.
Hitchcock							See App.
Hoffman							XIII, p. 481.
Holmes							See Miller.

*Ownerships shown in this table are those shown on assessment rolls.

TABLE OF QUARTZ MINES AND PROSPECTS TUOLUMNE COUNTY—Continued.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Homestake	12	1 S	14 E.	Homestake Mining Co. of Tuolumne, c/o Wm Burchett, 249 Granite St., Pacific Grove			See Rising Sun
Homestake	28	2 N.	16 E.	Wm. Mansfield, Tuolumne, Calif.	3300	20	
Homestead							XIII, p. 482
Hope	31	2 N.	14 E.	Hope Mines Dev. Co., Boston Bldg., Salt Lake City, Utah	2175	30	XIII, p. 482, XIV, p. 152
Hudson & Calhoun	18	2 N.	15 E.				XX, p. 21
Hughes Cons. & Dyneta	35	1 S.	15 E.	Green Cons. G. Mining Co., c/o Thos. Magee & Sons, 135 Sutter St., San Francisco		58	
	21	1 S.	15 E.				
Hull	1	1 S.	16 E.	Chas. F. Harper, Trustee, Box 277, Bakersfield		20	
Hunter	22	1 N.	16 E.		2250		XII, pp. 302-303.
J. G. Huston	13, 24	1 S.	14 E.	J. G. Huston, 2705 O St., Sacramento.		147	
	19	1 S.	15 E.				
Hyde	13, 23	2 N.	15 E.	Chas. L. Winchell, c/o G. C. Henley, P. O. Box 478, Sonora			VIII, pp. 670-672; X, p. 735. XI, pp. 501-502; XII, p. 299; XIII, p. 474; XIV, p. 138.
	24	2 N.	15 E.				
Imperial	36	2 N.	15 E.	Clio Vindicator Mining Co., Chinese Camp, c/o H. Haeuter	990	153	XIV, p. 152
Independent							See Confidence
Independent	31	2 N.	16 E.	Annie K. Sharwood, J. H. West, Mrs. C. Curnow, Soulsbyville et al		20	
Isabella & Gem	5	1 N.	14 E.	John C. Faxon, et al. c/o Mrs. Clotilda Faxon-Bachman, Sonora		20	
Jackson Flat	29	2 N.	14 E.	George Rowe, R. F. D. 1, Sonora			
James							XIII, p. 482
Joe Hooker, Wildcat	18	2 N.	16 E.	J. B. Bacon, Windsor		28	XIII, p. 482
John Royal	1	2 N.	14 E.	John Royal Mining Co., c/o A. H. Blakely, 316 Pasadena Ave., South Pasadena (also assessed to C. E. & Albert Smith, Columbia)		5	
Jones-Tarantula	2	1 S.	14 E.	Henry T. Gage, Merchants National Bank Bldg., Los Angeles	1400	110	XIV, p. 164.
Josephine	Mocca sin District			Mrs. Mary Ferretti c/o Mrs. W. J. Horan, 435 E. Poplar St., Stockton			XX, p. 153.
Julia	5	1 N.	15 E.	J. Sanguinetti, Box 235, Sonora		18	
Jumbo							XIII, p. 482.
Jumper & Golden Rule	27, 35	1 N.	14 E.	C. O'Shea and J. W. Schiffman, Jamestown	1360	26	X, p. 50; XIII, p. 482; XIV, pp. 152-153; Bull. 18, pp. 131-132.

Junction							XIII, p. 482.
Justice	19	2 N.	14 E.	F. McArdle, Sonora		12	
Kaiser							XIII, p. 482.
Kanaka	7	1 S.	17 E.	Mrs. Agnes Parr, London, England	2540	20	VIII, pp. 669-670; XII, p. 308; XIII, p. 482; XIV, p. 153.
Kelly	18	1 S.	15 E.	Peter M. Shaw, c/o Harriman Mining & Milling Co., Tribune Tower, Oakland		27	
Kelly No. Ext., Kelvin	23	3 S.	13 E.	Louis Green, 1001 Alaska Comm. Bldg., 310 Sansome St., San Francisco	2800	70	X, pp. 755-757; XI, pp. 504-505; XII, p. 303; XIII, p. 483; XIV, p. 153.
Kephart							XIII, p. 483.
Kincaid Flat Mining Co.						160	XI, p. 510.
King Solomon							XIII, p. 483.
Kites & Boyle							See Santa Isabel.
Kyne Keyes				J. J. Hughes, Chinese Camp			XII, p. 303; XIII, p. 483; XIV, p. 153.
Lady Washington				Part of United Mines Group			X, p. 752; XI, p. 498; XII, p. 303; XIII, p. 483.
La Gloria	21	1 S.	16 E.	A. DeFerrari, Groveland	2900	20	XIV, p. 153.
Lamphere	3, 10	2 N.	16 E.	No. Confidence Mining & Dev. Co., c/o Mrs. M. Klosnecke, Secretary, 6 Nogales St., Berkeley	4100	141	XII, p. 483; XI, pp. 503-504; XIV, p. 153.
La Preciosa	33	1 N.	16 E.	Preciosa Mining Co., c/o Robert Thorn, Sonora		20	
Last Chance							See Colby.
Last Chance							XVIII, p. 96.
Last Chance, Fair View	18, Sonora			Mrs. S. F. McGrane & Mrs. H. Eddy, c/o Mrs. Helen Fiske, Sonora			XI, p. 505; XIII, p. 483.
Last Chance, Free Trade, Charley Hales & Wilbur	8, 9	1 S.	14 E.	M. McCormick Mining Co., c/o Andrew McCormick, 1452 No. El Dorado St., Stockton		59	
Last & North Star	4, 32	1 N, 2 N	16 E.	L. M. Ashley, 1206 Rust Bldg., Tacoma, Wash.	2850	40	XI, pp. 498-499; XII, p. 306; XIII, pp. 483-484; XIV, pp. 158-154.
Last & Two O'Clocks, Toledo Claim, Fresno View	31, 32	2 N.	14 E.	Mrs. M. B. Clement, 459 Pardee Ave., Piedmont		22	X, p. 36; XIII, p. 484; XIV, p. 154.
Lava							See Seminole.
Lewis	10	2 N.	15 E.	William N. Lewis, Sonora	2580	20	XIV, p. 188.
Lewis Placers	28	3 S.	11 E.	Mother Lode Ore Mines, c/o P. F. Lautenschlager, Manager, Box 558, Mineral Falls		27	
Lilly Claim	34, 35	1 N.	14 E.	W. T. Bowden, c/o Mrs. Fanny Cocke, Jamestown		40	X, p. 742; XIII, p. 484.
Lilly, South							See Confidence.
Lilly, Western	24	1 S.	13 E.		2620		XII, p. 484.
Live Oak							See Stark Oak.
Lone Star	2	2 S.	14 E.	Fannie V. Cage, c/o Francis Cage, Jamestown		20	

*Acreage shown in this table not from chain or measurement notes.

TABLE OF QUARTZ MINES AND PROSPECTS, TUOLUMNE COUNTY—Continued.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Longfellow, Toughnut	30	1 S.	16 E.	A. G. Metz, 535 Van Nuys Bldg., Los Angeles	2900	16	VIII, pp. 672-673; XI, p. 494; XII, p. 303; XIII, p. 484; XIV, p. 154; Bull. 18, p. 139.
Lookout							See Pena Blanco
Los Angeles	31	1 N.	16 E.	J. S. Kuns, Los Angeles	1000	60	XIV, p. 154.
Louisiana	31	2 N.	16 E.	E. R. Pearce, 2353 Larkin St., San Francisco	3200	50	XIII, p. 484; XIV, pp. 154-155.
Lucky Boy	29	1 N.	16 E.	C. F. Stucki, Groveland	1200	40	XIV, p. 155.
Lucky Star							See Pena Blanco.
Lumsen				D. Lumsen & Sons, Big Oak			XI, p. 494; XII, p. 303; XIII, p. 484; XIV, p. 155.
Mack		1 S.	16 E.	A. G. Metz, 535 Van Nuys Bldg., Los Angeles	3100	20	XIII, p. 484; XIV, p. 155; Bull. 18, p. 140.
Madelon				J. W. Schiffman, P. E. Mertz, L. S. Grant, et al., Jamestown			XVII, p. 485.
Maddox	9	2 N.	16 E.	Jos. & Geraldine Maddox, Confidence		140	
Magnolia							See Old Tuolumne
Magruder	24	2 N.	14 E.	Louis, Mark & Miss Marian F. Page, Sonora		21	
Mammoth							XIII, pp. 484-485.
Mangante	10	1 N.	14 E.	Philomena Mangante Adm'r Estate Jos. Mangante, Sonora	1350	22	XIV, p. 155; Pre. Rep. 8, p. 40.
Manzanita	1, 2	1 N.	14 E.	Mary F. L. Scott & Amelia Coffer, c/o Mary F. L. Scott, Sonora		17	XI, p. 506.
Martin							See Philadelphia & Rhode Island.
Mary							XIII, p. 485.
Maryatt	32	2 N.	14 E.	Geo. E. Bates, 1509 de Young Bldg., 690 Market St., San Francisco		11	
	32	2 N.	13 E.				
No. Ext. Maryatt	31	2 N.	14 E.	J. W. Edwards, R. F. D. 1, Sonora		9	
Mary Ellen	32	1 N.	16 E.	A. B. Cruikshank, Chancery Lane Safe Deposit, Chancery Lane, W. C. 2, London, England		26	XI, p. 494; XIII, p. 486.
Mascot	10	1 N.	14 E.	D. L. Mann, Jamestown	1350	10	XI, p. 494; XIII, p. 485; XIV, p. 155
Mayflower	4	1 N.	16 E.	N. J. Miller, Lodi and F. W. Huber, Shawmut	2100	101	XIII, p. 485; XIV, pp. 155-156.
Mazeppa	35	1 N.	14 E.	Mazeppa Mine, Inc., c/o L. G. Baum, Jamestown	1250	43	XI, pp. 509-510; XIII, p. 485; XIV, p. 156.
McAlpine	18	2 S.	16 E.	McAlpine Mines Co., c/o Miss Fannie W. McLean, 1829 Bancroft Way, Berkeley	2200		X, p. 43; XIII, p. 485; XIV, p. 156.

McArdle	24	2 N.	13 E.	T. H. McArdle, et al., c/o F. McArdle, Sonora		18	
McCann							See Harvard
McCormick	8, 9	1 S.	15 E.	Andrew McCormick, 6 East Main St., Stockton	2000	59	XVII, p. 485; XX, p. 183; Pre. Rep. 8, pp. 40-41.
McCure							See Argall.
McTarnahan							XIII, p. 485.
Meade							XII, p. 304.
Merritt & Gold Nugget							XIII, p. 486.
Mexican							See Urquhardt.
Miller & Holmes							See Santa Ysabel Cons.
Mina Verde							XIII, p. 486.
Miracle	21	1 S.	16 E.	J. B. DeMartini, Groveland	2900	40	XIV, p. 156.
Miranda							See Argall.
Mississippi							See Eureka & Mississippi.
Mitchell	30	2 S.	14 E.	Rodden Brothers, 1st National Bank, Oakdale			Field Report.
Moccasin & Golden Key	6, 7	2 S.	16 E.	Moccasin Cons. Gold Mining Co., 626 Hearst Bldg., San Francisco	1200	160	XIV, p. 156.
Mohawk							XIII, p. 486.
Mohican	31, 32	1 N.	16 E.	Mohican Milling & Mining Co., 401 Alaska Commercial Bldg., San Francisco; R. E. McHale, agent	900	98	XIV, p. 156.
Mohrman	30	1 S.	16 E.	G. B. Musante, Big Oak Flat		15	
Monitor							XII, p. 304; XIII, p. 486.
Montreal Cons.	30	2 S.	14 E.	J. A. Gillis & F. L. Mitchell, R. F. D. 1, Sonora			
Monte Cristo							XIII, p. 486.
Moody	30	1 S.	16 E.	W. A. Nevills Estate	2780	20	XIV, p. 157.
Mooney							See Harvard
Mormon	30	1 S.	16 E.	G. B. Musante, Big Oak Flat	2850	20	XIII, p. 486; XIV, p. 157.
Morning Glory				C. Layman & J. A. King, Confidence	3010		
Mother Lode				See Kelly			XIII, p. 486.
Mountain Bell & Parallel	30	2 N.	16 E.	Annie K. Sharwood, John N. & E. W. S. Woods, c/o Wilhoit & Sons, Stockton		22	
Mt. Jefferson	21	1 S.	16 E.	Ernest W. Harker, c/o Attorney H. M. Anthony, Humboldt Bank Bldg., San Francisco	2900	30	XII, p. 304; XIII, p. 466; XIV, p. 157.
Mount Stanislaus							XIII, p. 486.
Mount Vernon & Green Cons	1 36	2 N. 3 N.	16 E. 16 E.	Green Cons. Gold Mining Co., c/o Thos. Magee & Sons, 135 Sutter St., San Francisco		53	XIII, p. 486; XIV, p. 146.
Mountain View Cons.	31, 32	2 N.	14 E.	Green Cons. Gold Mining Co., c/o Thos. Magee & Sons, 135 Sutter St., San Francisco		35	
Mountain View	3	15 N.	14 E.	Mrs. Maria Conselo, Heirs of W. G. Rowe, Chinese Camp		21	
Mt. Zion	21	1 S.	16 E.	F. L. Cassaretto, H. Cramer Estate, Groveland, et al.			XII, p. 304; XIII, p. 486.

*Ownerships shown in this table are those shown on assessment rolls.

Name of mine	Location			Owner's name and address	Elevation, feet, Bed	Area, acres	Bibliography
	Sec.	Twp.	Range				
Vanderal Group	25, 26	1 S.	14 E.	Sierra Mining Co., c/o A. J. Wiley, 917 C. C. Chapman Bldg., Los Angeles	1300		XV[illegible], p. 48; XVIII, p. 18; Pls. Supp. 8, p. 41
Veale							See Sugarman
Veubaumer	19	2 N.	14 E.	H. & H. F. Neubaumer, c/o H. C. Neubaumer, Oakdale		14.5	XIII, p. 487
Vivar-Sweat				James Ballentine, Big Oak Flat			XII, p. 309; XIII, p. 366; XIV, p. 137
Vivo Albany				Part of United Mines Group			VIII, p. 286; X, p. 330; XI, p. 467; XII, p. 324; XIII, p. 487
Vivo Era				Part of Jumper			XI, p. 466; XIII, p. 487
Vivo Grand Turk	20	2 N.	14 E.	A. W. Shirfield, Tuttletown		20	
Vivo Vest	15, 16	1 N.	16 E.	Geo. C. Mullet & Mary M. Hemingsen, c/o C. C. Moore, Apt. 6, 1484 Larkin St., San Francisco	2200	20	XII, p. 324; X, pp. 737-738
Vivo Vest				Mrs. Rosa Wainwright, Sonora			XIII, p. 487; XIV, p. 137
Vonganill	18	1 S.	18 E.	See Phil O'Neil Mine	2500	20	XIII, p. 487
Vonnelly				Walter H. Liebeck, 712-734 Crocker Bldg., San Francisco			XIII, p. 487
Vorth Confidence	4, 9	2 N.	16 E.	See Confidence Mining & Dev. Co., c/o Mary Kennedy, Secretary, 6 Seaside St., Berkeley			See Longhire
Vorth Extension							XIII, p. 487
No. Fat of Gwen mine	36	3 N.	16 E.	Phil M. Ryan, Sonora		21	
North Fork							See Dynamite
North Star							See Liberty & North Star
North Star, Black Warrior, Yellow Jacket	21, 28	1 S.	15 E.	John M. Bains, M. S. de Alvarado, 815 Phoenix Block Bldg., San Francisco		58	XIII, p. 487
Norwegian	18, 19	2 N.	14 E.	H. A. & M. E. Hamlin, 61 Stockton St., San Francisco	1950	30	XIV, p. 137; Bull. 18, p. 100
Not Ere	[illegible]	[illegible] N.	[illegible] E.	[illegible]		17	See Table, Calaveras County
O'Donnell	15	1 N.	14 E.	W. C. & C. E. Rudy, c/o W. Rudy, Route 1, Box 210, Stockton	1450	20	XIV, p. 137
O'Hara	25	2 N.	14 E.	J. F. & James O'Mara, Sonora	1600	37	XII, p. 335; XIV, p. 137; XIII, p. 487
Ohio							
O. K. & No. Key	34	2 N.	14 E.	Tuolumne Co. Bank, c/o C. H. Segerstrom, Sonora	1400	67	XI, p. 348; XII, p. 307; XIII, p. 487; XIV, p. 378

Old Dominion	2	2 N.	14 E.	Richard G. Bell, Columbia	2400	120	XIV, p. 158.
Old Toulumne	1	2 N.	14 E.	Old Tuolumne Mining & Dev. Co., c/o W. F. Geary, P. O. Box 497, Sacramento	1860	89	XII, p. 305; XIII, p. 487; XIV, p. 158.
	6	2 N.	15 E.				
	36	3 N.	14 E.				
Olsen	32	2 S.	14 E.	H. J. Langdon, c/o D. C. Demarest, Angels Camp		20	
Omega Table Mountain Gravel Mine	6	1 N.	14 E.	Peter A. Herivel, ⅞; Chas. E. Beyer, ⅛, c/o P. A. [illegible]	1200	80	XIV, p. 158; XIX, pp. 10, 145; XX, p.
O. P.	7	2 N.	16 E.	Edna Callender, Mrs. Ira Condit, 908 Indian Rock Ave., Berkeley; Mary Marsicano, 781 Green St., San Francisco, et al		21	
Ophir				James Brothers, Groveland			XII, p. 305; XIII, p. 487; XIV, p. 158.
Ophir				Chas. Bryan, Big Oak Flat			
Orcutt							See Mammoth.
Orin							See Old Tuolumne.
Oversight		1 S.	15 E.	Jas. Blankenship, Big Oak Flat		12	
Pacific, Vulture, Pine Ridge & Irish	15, 16	1 N.	14 E.	Estate of B. M. Newcomb, c/o R. P. Newcomb, 1409 Grand Ave., Piedmont			XIII, p. 482.
	20	1 N.	14 E.				
Page	25	2 N.	14 E.				XII, p. 305; XIII, pp. 487-488.
Palo Alto							XIII, p. 488.
Parole	18	2 N.	16 E.	G. T. Barron, Tilden, et al., Soulsbyville		25	XIII, p. 488; XVIII, p. 101.
Patterson, Lennon	29	2 N.	14 E.	Elfreda Davis Wright, ⅓, c/o B. B. Brace, Oakland Bank Bldg., Oakland; C. A. Fitzgerald, Quartz, ⅔	1500	45	VIII, pp. 656-657; XII, p. 305; XIII, p. 488; XIV, p. 158; XVII, p. 485; XVIII, pp. 100-101; XIX, p. 74; Pre. Rep. 8, p. 41.
Paymaster							XVIII, p. 101.
Peck	30	2 S.	14 E.	J. G. Hopper, c/o Wm. H. Metson, San Francisco			
Pedro							See Stonewall.
Pena Blanco		1 N.	14 E.	Ross & Chamberlain, c/o J. I. Ross, Redwood City		55	XIII, p. 488; XIV, p. 159.
Pennsylvania	5	1 N.	16 E.		2800		XI, p. 500; XIII, p. 488.
Pennsylvania							See Soulsby.
Pet Cossey	20	1 S.	15 E.	Estate of Anna A. Preston, c/o G. M. Booker Fletcher		14	
Philadelphia, Boston & Rhode Island	16, 21	1 N.	16 E.	Wm. H. Mathewson, Tuolumne			XIII, p. 488.
Phil O'Neill	19	1 S.	16 E.	Ernest W. Harker c/o H. M. Anthony, Humboldt Bank Bldg.			See Nonpareil.
Phoenix Lake	36	2 N.	16 E.	Phoenix Lake G. Mining Co., c/o Jno. Frey, 7th & Berry St., San Francisco			

*Quantities shown in this table are those shown on assessment rolls.

TABLE OF QUARTZ MINES AND PROSPECTS, TUOLUMNE COUNTY—Continued.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
National Group	23, 26	1 S.	15 E.	Sierra Mining Co., c/o A. T. Waltz, 917 C. C. Chapman Bldg., Los Angeles	2500		XVII, p. 485; XVIII, p. 100; Pre. Rep. 8, p. 41.
Neale							See Sugarman
Neubaumer	19	2 N.	14 E.	H. & H. F. Neubaumer, c/o H. G. Neubaumer, Oakdale		140	XIII, p. 487.
Never-Sweat				James Ballentine, Big Oak Flat			XII, p. 304; XIII, p. 366; XIV, p. 157.
New Albany				Part of United Mines Group			VIII, p. 665; X, p. 752; XI, p. 497; XII, p. 304; XIII, p. 487.
New Era				Part of Jumper			XI, p. 509; XIII, p. 487
New Grand Turk	29	2 N.	14 E.	A. W. Stinchfield, Tuttletown		20	
New Year	15, 16	1 N.	16 E.	Cora G. Muller & Mary M. Henningsen, c/o C. C. Muller, Apt. 6, 1480 Larkin St., San Francisco	2250	20	XII, p. 304.
New York				Mrs. Helen Wainwright, Sonora			X, pp. 737-738.
Nonpareil	19	1 S.	16 E.	See Phil O'Neill Mine	2800	20	XIII, p. 487; XIV, p. 157.
Noonday				Walter H. Linforth, 712-714 Chronicle Bldg, San Francisco			XIII, p. 487.
North Confidence	4, 9	2 N.	16 E.	No. Confidence Mining & Dev. Co., c/o Mary Kleinecke, Secretary, 6 Nogales St., Berkeley			See Lamphere.
North Extension							XIII, p. 487.
No. Ext. of Green et al.	36	3 N.	16 E.	Phil. M. Ryan, Sonora		31	
North Fork							See Donnella.
North Star							See Laura & North Star.
North Star, Black Warrior, Yellow Jacket	21, 28	1 S.	15 E.	John M. Babra, M. S. de Albergaria, 615 French Bank Bldg., San Francisco		56	XIII, p. 487.
Norwegian	18, 19	2 N.	14 E.	H. A. & M. E. Hornlein, 15 Stockton St., San Francisco	1200	39	XIV, p. 157; Bull. 18, p. 129.
	30	2 N.	14 E.				
Nut Pine	32	2 N.	14 E.	Clarissa A. Trittenbach, R. F. D. 1, Sonora		10	
Nyman Cons.							See Santa Ysabel Cons.
O'Donnell	15	1 N.	14 E.	W., C. & C. E. Rudy, c/o W. Rudy, Route 1, Box 210, Escalon	1150	20	XIV, p. 157.
O'Hara	25	2 N.	14 E.	J. F. & James O'Hara, Sonora	1900	27	XII, p. 305; XIV, p. 157.
Ohio							XIII, p. 487.
O. K. & No. Ext.	32	2 N.	14 E.	Tuolumne Co. Bank, c/o C. H. Segerstrom, Sonora	1300	40	XI, p. 508; XII, p. 305; XIII, p. 487; XIV, p. 158.

Old Dominion	2	2 N.	14 E.	Richard G. Bell, Columbia	2400	120	XIV, p. 158.
Old Toulumne	1	2 N.	14 E.	Old Tuolumne Mining & Dev. Co., c/o W. F. Geary, P. O. Box 497, Sacramento	1860	89	XII, p. 305; XIII, p. 487; XIV, p. 158.
	6	2 N.	15 E.				
	36	3 N.	14 E.				
Olsen	32	2 S.	14 E.	H. J. Langdon, c/o D. C. Demarest, Angels Camp	----	20	
Omega Table Mountain Gravel Mine	6	1 N.	14 E.	Peter A. Herivel, 7/8; Chas. E. Beyer, 1/8, c/o P. A. Herivel, 590 I. W. Hellman Bldg., Los Angeles	1200	89	XIV, p. 158; XIX, pp. 19, 145; XX, p. 21.
O. P.	7	2 N.	16 E.	Edna Callender, Mrs. Ira Condit, 908 Indian Rock Ave., Berkeley; Mary Marsicano, 781 Green St., San Francisco, et al.	----	21	
Ophir	----	----	----	James Brothers, Groveland	----	----	XII, p. 305; XIII, p. 487; XIV, p. 158.
Ophir	----	----	----	Chas. Bryan, Big Oak Flat	----	----	
Orcutt	----	----	----	----	----	----	See Mammoth.
Orin	----	----	----	----	----	----	See Old Tuolumne.
Oversight	----	1 S.	15 E.	Jas. Blankenship, Big Oak Flat	----	12	
Pacific, Vulture, Pine Ridge & Irish	15, 16	1 N.	14 E.	Estate of B. M. Newcomb, c/o R. P. Newcomb, 1409 Grand Ave., Piedmont	----	----	XIII, p. 482.
	20	1 N.	14 E.				
Page	25	2 N.	14 E.	----	----	----	XII, p. 305; XIII, pp. 487-488.
Palo Alto	----	----	----	----	----	----	XIII, p. 488.
Parole	18	2 N.	16 E.	G. T. Barron, Tilden, et al., Soulsbyville	----	25	XIII, p. 488; XVIII, p. 101.
Patterson, Lennon	29	2 N.	14 E.	Elfreda Davis Wright, 1/3, c/o B. B. Brace, Oakland Bank Bldg., Oakland; C. A. Fitzgerald, Quartz, 2/3	1500	45	VIII, pp. 656-657; XII, p. 305; XIII, p. 488; XIV, p. 158; XVII, p. 485; XVIII, pp. 100-101; XIX, p. 74; Pre. Rep. 8, p. 41.
Paymaster	----	----	----	----	----	----	XVIII, p. 101.
Peck	30	2 S.	14 E.	J. G. Hopper, c/o Wm. H. Metson, San Francisco	----	----	
Pedro	----	----	----	----	----	----	See Stonewall.
Pena Blanco	----	1 N.	14 E.	Ross & Chamberlain, c/o J. I. Ross, Redwood City	----	55	XIII, p. 488; XIV, p. 159.
Pennsylvania	5	1 N.	16 E.	----	2800	----	XI, p. 500; XIII, p. 488.
Pennsylvania	----	----	----	----	----	----	See Soulsby.
Pet Cossey	20	1 S.	15 E.	Estate of Anna A. Preston, c/o G. M. Booker Fletcher	----	14	
Philadelphia, Boston & Rhode Island	16, 21	1 N.	16 E.	Wm. H. Mathewson, Tuolumne	----	----	XIII, p. 488.
Phil O'Neill	19	1 S.	16 E.	Ernest W. Harker c/o H. M. Anthony, Humboldt Bank Bldg.	----	----	See Nonpareil.
Phoenix Lake	36	2 N.	16 E.	Phoenix Lake G. Mining Co., c/o Jno. Frey, 7th & Berry St., San Francisco	----	----	

*Ownerships shown in this table are those shown on assessment rolls.

TABLE OF QUARTZ MINES AND PROSPECTS, TUOLUMNE COUNTY—Continued.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Pine Log	36	3 N.	14 E.	United Mines Co., c/o F. L. Mitchell, Columbia			
Pine Nut	31	1 N.	16 E.	J. W. Purdy Estate, Mrs. Emma Edmiston, 416 Broderick St., San Francisco, trustee		21	
Pine Tree							XVIII, p. 99.
Pi-Ute							XII, p. 305; XIII, p. 489.
Plowboy							See Confidence.
Platt & Gilson							See Soulsby.
Poison Oak	24	1 N.	15 E.	Yankee Hill G. Mining Co., c/o A. J. Padgham, President, Santa Rosa	2000	200	Field Report.
Poor Man's Friend							XI, p. 498.
Porto Fino	5	1 N.	16 E.	Porto Fino Mine, c/o Mrs. E. L. Hill, Box 553, Tuolumne			
Pride of Tuolumne							XIII, p. 489.
Prospect	6	1 N.	14 E.	D. Martin, Jamestown, et al.			
Providence	9	1 N.	16 E.	New Providence Gold Mining Co., 2041 Emerson St., Berkeley	2600	90	XIII, pp. 478-479; XIV, p. 159; Bull. 18, p. 138.
Prudhomme, Cordova	33	2 N.	16 E.	Claire McNee, c/o M. W. McIntosh, 114 Sansome St., San Francisco	3550		XIII, p. 489.
Puerto-Fino				William Sharwood, Soulsbyville			XII, p. 306; XIII, p. 489; XIV, p. 159.
Punter	12	1 N.	14 E.	Wm. Punter, Sonora		20	
Raggio	19, 20	1 S.	16 E.	Mrs. Norman Smith, 4227 14th Ave., Route 4, Box 197, Sacramento, et al.		5	XIII, p. 489.
Rappahannock	5	1 N.	14 E.	J. C. Webster, Sonora & A. C. Mohr, Associated, Contra Costa County, California	1625	33	XII, p. 306; XIII, p. 489; XIV, p. 159.
Rattlesnake	5	1 N.	16 E.	Alice G. Newton, Box 52, Fairfax		13	
Rawhide	4, 5 8, 9	1 N. 1 N.	14 E. 14 E.	Central Land Co., c/o Union Trust Co., San Francisco	1670	291	X, p. 54; XI, pp. 507-508; XII, p. 306; XIII, p. 489; XIV, pp. 159-160; XVIII, p. 101; Pre. Rep. 8, p. 41; Bull. 18, pp. 129-130.
Rawhide No. 2				A. Hayward Estate, San Francisco			XII, p. 306; XIII, p. 489; XIV, p. 160.
Ready							See Hoffman.
Red Cross							See Omega.
Redemption & Ice House	8	2 N.	15 E.	Estate of Eugene Ellis, c/o Mrs. J. W. Ellis, Columbia		18	

Red Jacket	29	1 S.	16 E.	V. J. Repetto, Big Oak Flat	2900	20	XIII, p. 489; XIV, p. 160.
Relief & Surplus	29, 30	2 N.	14 E.	Mayme Irene Jacobs & Chas. F. Helman, c/o Mrs. Jacob Myer, 373 10th Ave., San Francisco		15	
	32	2 N.	14 E.				
Republican	12, 13	1 S.	14 E.	Republican Mining & Development Co., Mills Bldg., San Francisco	900	87	X, p. 47; XIII, p. 489; XIV, p.160; Bull. 18, pp. 133-134.
	18	1 S.	15 E.				
Reward, Madsion, April	13, 24	2 N.	16 E.	John Rocca, Jamestown		36	
Rhode Island	21	1 S.	16 E.	Santa Ava Mining Co., c/o Frank J. Callahan, 162 Federal St., Boston, Mass.	2800		XIII, p. 489.
Ribbon Rock							See Old Tuolumne.
Rice							XVIII, p. 99.
Richards	9	1 N.	16 E.	Thos. and Miss M. K. Richards, Sonora, et al.			XIII, p. 489.
Riffle	5	2 N.	15 E.	J. K. Hunter Estate, c/o Street & Street, 708-709 Hobart Bldg., San Francisco			
Rikert Homestake							XIII, p. 489.
Rising Sun	28	2 N.	16 E.	William Mansfield, Tuolumne	3300	20	XI, pp. 503-504; XIII, p. 482; XIV, p. 161.
Ritchie	30	2 N.	14 E.		1500		XIII, pp. 489-490.
Riverside	26	3 N.	15 E.	Riverside Quartz. Mining Co., c/o Mrs. E. H. Williams, 948 Peralta Ave., San Leandro	1960	18	XIII, p. 490; XIV, p. 161.
Riverside et al.	21	1 S.	15 E.	D. E. Stratton, Sonora		129	
Robinson	19	1 S.	16 E.	B. L. A. Harker, c/o H. M. Anthony, Humboldt Bank Bldg., San Francisco			
Roosevelt et al.	7, 8	3 N.	15 E.	Charles Martin, 425 de Young Bldg., San Francisco		147	
Ross							XIII, p. 490.
Royal Granite							XIII, p. 490.
Russell Ranch							XVIII, p. 101.
Ryan Group	36	3 N.	16 E.	James Ryan, Sonora		70	
Sailor Boy							XIII, p. 490.
San Guiseppe				Fred Sutton, Sonora			VIII, pp. 654-656; X, pp. 740-741; XII, p. 306; XIII, p. 490; XIV, p. 161.
Santa Maria							XII, p. 306; XIII, p. 490.
Santa Ysabel Cons.	27	1 N.	14 E.	Nyman Cons. Mines Co., c/o F. G. Mudgett, Secretary, 502 Humboldt Bank Bldg., San Francisco	1550	100	X, p. 51; XII, p. 304; XIII, p. 490; XIV, p. 161; XVIII, p. 101; Bull. 18, p. 131.
Santissima	30	2 N.	14 E.	W. R. Gillis, ½; Jeanna Bluett, ½, R. F. D. 1, Sonora		9	
Sarah Francis							See Pena Blanco.
Seeber							VIII, p. 664.
Sell	30	2 N.	15 E.	Estate of J. K. Sell & W. M. Sell, Ahwahnee	2400	20	XIII, p. 490; XIV, pp. 161-162.
Seminole	9	1 N.	15 E.	O. F. Heizer, C. F. Holman, Sonora	2690	20	XIII, p. 491; XIV, p. 162.

*Ownerships shown in this table are those shown on assessment rolls.

TABLE OF QUARTZ MINES AND PROSPECTS, TUOLUMNE COUNTY—Continued.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Severt Cons.	19	2 N.	15 E.	J. Mitchel, Box M., Sonora			
Shanghai	6, 7	2 N.	15 E.	R. H., L. V. & M. A. Morgan, c/o Lon P. Fraser, 3042 College Ave., Berkeley			XIII, p. 491.
Shawmut et al.	1, 2	1 S.	14 E.	Eagle Shawmut Mining Co.			
	11, 12	1 S.	14 E.				
	13	1 S.	14 E.				
Shaw Flat							VIII, pp. 674-675.
Shaw & Scheller							See Street Mine.
Sheepherder							VIII, p. 675.
Silken				C. P. Hall & C. A. Hall, Big Oak Flat			XII, p. 306; XIII, p 491; XIV, p. 162.
Sierra G. Mining Co.	In Gro	veland		c/o E. N. Berkecker, Arlington Heights, Illinois			
Slver Star							XIII, p. 491.
Silver Star							XIII, p. 491.
Simonich							See Page.
Slap Jack	27	1 S.	16 E.	C. E. Smith, Groveland	2900	20	
Smooth Bore	5, 4	2 N.	15 E.	E. W. Murphy, 112 Union St., Oakland; A. A.			
	8, 9	2 N.	15 E.	Kress, 1116 Union St., Oakland			
Snell	8	3 N.	15 E.	Col. Dorsey Estate, San Francisco	2600		XI, p. 505; XIII, p. 491; XIV, p. 162.
Sobrante							See Harvard.
Somerset	15, 22	1 N.	16 E.	M. Sharwood, c/o Annie K. Sharwood, 2808 Woolsey St., Berkeley		14	
Sonnet	26	3 N.	15 E.	R. C. Davis, Columbia, et al.	2800	40	XIV, p. 162.
Sonora Cons.							X, pp. 748-750; XIII, p. 306.
Sonora Extension							See Rising Sun.
Sonora Wonder							XIX, p. 145.
Sonorita							XIII, p. 491.
Sophia							See Sugarman & Nigger.
Soulsby, Gibson Johnson & Bradbury, Churchill, Platt	31	2 N.	16 E.	Soulsby Cons. G. Mining Co., c/o Bagdad Chase G. Mining Co., 326 Cutter Bldg., Rochester, N. Y.	2900	160	VIII, p. 666; X, pp. 742-744; XII, p. 305; XIII, p. 475; XIV, p. 162.
Spring Gulch	21	1 N.	16 E.	Mrs. Mary C. Lord, Sonora	2700	39	XIII, p. 492; XVIII, p. 101; XX, p. 21.
Stanley	17	1 S.	15 E.		900		XI, p. 510; XIII, p. 492.
Stanley & Bean							See Godfrey.
Star	23, 24	3 N.	15 E.	E. A. & J. O. Hayes, 608 First National Bank, San Jose	2300	20	XIII, p. 492; XIV, p. 163.

Starr King	15	1 N.	16 E.	Donald C. Kennedy, 545-553 Golden Gate Ave., San Francisco	3000	40	XIV, p. 163.
Stenchfield							See Chileno.
Stewart							XIII, p. 492.
Stocker							XVIII, p. 99.
Stockton	7, 8	3 N.	16 E.	Stockton G. Mining Co., c/o W. C. Ramsey, Record Office, Stockton		542	XIII, p. 492.
	17	3 N.	16 E.				
	12, 13	3 N.	15 E.				
Stonewall	25	2 N.	14 E.	William Pedro, Sonora	1900	20	XIV, p. 163.
Street	29	2 N.	14 E.	A. A. Smith, 1128 Broadway, Oakland	1500	20	XIII, p. 492, XIV, p. 163.
Stuart & Morris	25, 26	2 N.	14 E.	Helen Wainwright, Frank Tomisson, Sonora, et al.	2100	40	XIV, p. 163.
Sugarman & Nigger	30	2 N.	14 E.	F. M. Butler, C. F. Smith, C. R. Watson, Sonora	2300	25	XIII, p. 492; XIV, p. 163.
	19	2 N.	15 E.				
Sullivan							XIII, p. 492.
Summers							See Richards.
Summers	9	1 N.	16 E.	Mary W. & Mac D. Crawford, c/o Anglo & London Paris National Bank, San Francisco; T. Richards & Miss M. K. Richards, Sonora		24	
Sweeney	15	1 N.	14 E.				XIII, p. 492.
Swerer	32	2 N.	14 E.		1550		XIII, p. 493
Tam O'Shanter	31, 32	2 N.	14 E.	Mrs. M. R. Clement, 422 Pacific Ave., Piedmont			
Tanzy	36	2 N.	14 E.	J. F. O'Hara, Sonora	2100	10	XIII, p. 493; XIV, p. 164.
Tarantula	5	1 N.	14 E.	Eric J. Segerstrom, Sonora	1600	18	XIII, p. 493; XIV, p. 164.
		2 N.	14 E.				
Tarantula-Gold Ridge-Reitz Group				See Jones			XVII, pp. 485-486.
Temescal	34	3 N.	16 E.		2700		XX, p. 21.
Thompson Hill, Gillis, Alta	29, 30	2 N.	14 E.	W. R. Gillis, Tuttletown		59	
Tin Can, Santa Claus	20	2 N.	14 E.	Fred Bryant, R. F. D. 1, Sonora		20	
Todd & Hunter							See Hunter.
Toledo	21	2 N.	14 E.	Mrs. M. R. Clement, 422 Pacific Ave., Piedmont	1400		XIII, p. 493.
Trio							See Harvard.
True Business	12	3 N.	14 E.	Estate of J. B. Curtin, Estate of T. B. Dorsey, Estate of Caleb Dorsey, c/o Mrs. Lucy Curtin, Sonora		21	
	11, 2	3 N.	15 E.				
	7	3 N.	15 E.				
Triumph	9, 10	1 N.	16 E.	Al. C. Maier & Bessie L. Carter, 1802 Blake St., Berkeley		18	
Turner	26	2 N.	13 E.	Carrie M. & Minnie Turner c/o Dr. W. W. Douglas, 323-A. S. Main St., Hillsboro, Ill		18	
Two Brothers	19, 20	1 S.	16 E.	Two Brothers' Mining Co., c/o J. J. LeTourneau, 2643 Hillegas Ave., Berkeley			
Uncle Sam	20	1 N.	16 E.	Mrs. Mary Lord, 4532 W. 18th St., Lodi		60	

*Ownerships shown in this table are those shown on assessment rolls.

TABLE OF QUARTZ MINES AND PROSPECTS, TUOLUMNE COUNTY—Continued.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
United	36	3 N.	14 E.	United Mines Co. of California, c/o F. L. Mitchell, Columbia			
United Mines Group	9, 4	1 N.	16 E.	Grizzly Mining Co., c/o Horace M. Street, 709 Hobart Bldg., San Francisco	2000	169	XIV, pp. 164-165; Pre. Rep. 8, p. 41.
Union & Rough & Ready	27, 28	1 S.	15 E.	J. W. Stevens, 2703 Webster St., Oakland			
Urquhardt							XIII, p. 493.
Utopia							XIII, p. 493.
U. S. Grant	26	3 N.	16 E.	Lake Superior & Nevada Dev. Co., 218 W. Superior St., Duluth, Minnesota	2600	200	XIV, p. 164.
Vallecito	11, 14	4 N.	15 E.	Vallecito Mining Co., c/o L. M. Hoefler, 105 Montgomery St., San Francisco		320	
Valparaiso	29	2 N.	14 E.	Walter Krause, Mrs. Geo. Crozier, Mrs. Jessie N. Lawson, 124 Roosevelt Ave., Redwood City			XIII, p. 493.
Verdun				Solari, June and Mangante			XVII, p. 486; XVIII, p. 101.
Victoria	17	1 S.	15 E.	Wm. Musso & G. B. Pietronave c/o Golden Poppy Mining Co., Friedburger-Blodgett Bldg., Lodi		18	
Vigilance							See Old Tuolumne.
Vine Spring	3	2 N.	14 E.	S. Whetmore, J. V. Bannister, Columbia, et al.	2000	20	XIV, pp. 165-166.
Violet							XIII, p. 493.
Virginia							See Argall.
Virginia							See Garfield-Virginia.
Volunteer	4	2 N.	15 E.	W. W. Fraser, Box 1104, Richmond		18	
Vulture	15, 16	1 N.	14 E.	R. P. Newcomb, 1409 Grant Ave., Piedmont		11	XIII, p. 493.
Waif	34	2 N.	15 E.	A. Matilda Hanke et al., 921 Market St., Oakland			
Wall St. & Sugar Pine	22	2 N.	16 E.	Duncan McLaren, c/o Rowan Hardin, Sonora		40	
Waterman							XIII, p. 493.
Watson							XIII, p. 493.
Wheal & Perrin	30, 31	2 N.	16 E.	Glasson & Co., c/o Wm. C. Glasson 1426-E 14th St., San Leandro			XIII, p. 493.
Wheal Rough	6	2 N.	15 E.	George A. & Thomas Richards, Sonora; Salve Olsen, Sonora; Mrs. E. C. Wetmore, Sonora; J. W. Richards, 602 14th St., Modesto, et al.	2850	9	XIII, p. 493; XIV, p. 166.
Wheeler							XII, p. 307; XIII, p. 493.
Whiskey Hill							See Harvard Mines.
White Oak							See Black Oak.

Whitto	35, 36	2 N.	15 E.	M. McCormick Co., c/o Andrew McCormick, 1432 No. El Dorado St., Stockton	2800	25	XIII, p. 494; XIV, p. 144.
	1	1 N.	15 E.				
Wickham	32	2 N.	14 E.	Margaret J. Hampton, Sonora		13	
Wild Cat, Aget, Lucky Strike, Iron							XIII, p. 494.
Wild Missourian							See Old Tuolumne.
Willieta	18, 19	1 S.	15 E.	Estate of David Graham, c/o Mrs. Thos. J. Russell, Chinese Camp	850	20	XIII, p. 494; XIV, p. 166.
Wilson & Means, Rice, Stoker, Gillis & Carrington	30	2 N.	14 E.	James A. Gillis, R. F. D. 1, Sonora		37	
Winchester							XII, p. 307; XIII, p. 494.
Winnie							See Crystalline.
Wise	29, 31	2 N.	14 E.	Stephen Davey & A. A. Swerer, Tuttletown	1440	18	XIV, p. 166.
	32	2 N.	14 E.				
Wooters				R. B. Lane, c/o H. J. McMahon heirs, 825 9th St., Marysville			XIII, p. 494.
Worcester	8, 9	1 N.	16 E.	Chas. E. Meade, Tuolumne	2700	21	XIII, p. 494.
	16, 17	1 N.	16 E.				
Yancy							XIII, p. 494.
Young American							See Seminole Group.

*Ownerships shown in this table are those shown on assessment rolls.

GOLD (PLACER MINES).

While the placer mines of the county were among the richest in the state, there is little to be added at this time to the past reports on this branch of the industry. Most of the later placer gold production has been from small operations carried on by one or a few men each. The only company that has worked steadily has been the *Springfield Tunnel and Development Company,* whose property and operations have been heretofore described. They have not reported any developments of importance for several years.

The total production of placer gold in the county in 1926 was $9,681 from 17 producers, and for the past twenty years the yearly placer gold output has been small. This is in marked contrast to the early mining history of the region. The shallow placers of the Columbia and Springfield districts are commonly claimed to have produced $55,000,000 as indicated by express company's records, and the other districts of the county are credited with an output of $101,000,000. Of these, the most important were: Groveland, Deer Flat and Big Oak Flat, with a total output of $25,000,000; Sonora, $11,000,000; Don Pedro Bar, Jacksonville and Stevens Bar, together credited with $9,000,000; Gold Springs and Nigger Gulch, $7,500,000 and many others.

The county was famous also for the many large nuggets found. The surface and shallow placers were the richest, and the buried channels in place have produced a comparatively small part of the total. Erosion of the Mother Lode contributed to the richness of the deposits in the western part of the county, as did that of the pocket veins in the vicinity of Sonora and Bald Mountain. The erosion and concentration of vast quantities of bedrock material and segments of ancient channels which were themselves 'spotted' or even low in gold content, accounts for the great quantities of gold found in the shallow placers.

The ancient channel systems crossing the county have been discussed in detail by Lindgren[1] and Haley,[2] and the mines have been described in many of the bureau's past publications, as will be seen by reference to the bibliography in the accompanying list of placer mines. Three channel systems have been traced across the county. The most productive, since its erosion fed the Columbia basin, was the so-called Columbia Channel, of which one branch traversed the ridge by way of Sugar Pine and Confidence, passing near Soulsbyville and going thence to Columbia with a branch entering from the north near the crossing of Woods Creek. Little, if any, success has attended the efforts to mine the upper reaches of this channel although several attempts have been made in recent years. The district immediately surrounding Confidence is the most easterly on the course of this stream where valuable quartz veins are known, and where enrichment of the stream channels might be expected to begin. The ridge from Confidence to a point south of Soulsbyville is covered by andesite, but the section west of there has been completely eroded and reconcentrated except for a few isolated lava caps. Another channel, mostly removed by erosion, traversed the southern part of the county from the vicinity of Hetch-Hetchy in a westerly direction through Chinese Camp. The system of

[1] Lindgren, W., U. S. Geol. Survey, Prof. Paper 73.
[2] Haley, Chas. S., Calif. State Min. Bur. Bull. 92, pp. 148–150.

channels under Table Mountain in the western section has been prospected ever since the fifties but the gravel has only occasionally been found payable. It is presumed that this 'spotted' character is due to the fact that the channels are later ones which did not erode through the early volcanic flows into the auriferous bedrock formations and consequently such gold as they contain was picked up where they crossed and eroded earlier channels.

TABLE OF PLACER MINES AND PROSPECTS, TUOLUMNE COUNTY.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Ah Mow							See White Lead.
Barley Ranch, American Camp	20	3 N.	15 E.	Archie A. Morrison, La Grange		90	
Bedrock Blue Gravel	27	2 N.	14 E.	Heirs of Duchow Estate, c/o E. M. Duchow, 2111 I St., Sacramento		40	Field Report.
Bell Mine	2, 3	2 N.	14 E.	Wm. & Hildegard Grant, Hobart Bldg., San			
	34, 35	3 N.	14 E.	Francisco		741	
Best Twenty	17	1 N.	14 E.	Mrs. Cecile Shafer, Jamestown		20	
Boston	33	2 N.	14 E.	D. T. & E. W. Morris, R. F. D. 1, Sonora, et al.	1575	160	X, pp. 737-738.
Buckeye	27, 34	2 N.	14 E.	Table Mountain Mining Co., c/o Francis Wilson, R. F. D. 1, Sonora	1800	120	X, pp. 737-738; XIV, p. 166.
Buckeye Gravel	27, 28	2 N.	14 E.	A. W. Stinchfield & F. L. Mitchell, R. F. D. 1,			
	33, 34	2 N.	14 E.	Sonora	1800	20	X, pp. 737-738.
Canondale							XII, p. 300; XIII, p. 475.
Cave Diggings	28, 29	1 N.	16 E.	Mrs. Annie K. Sharwood, 2808 Woolsey St.,			
	33	1 N.	16 E.	Berkeley		155	XIII, p. 475.
Cherokee	21, 30	2 N.	16 E.	Cherokee Gravel & Gold Mining Co., Soulsbyville	2900	300	XIV, p. 166; XX, p. 20.
	32	2 N.	16 E.				
Colorado, Zemicraw & Yankee	7	2 N.	15 E.	M. L. Kaplin, 438 So. Olive St., Los Angeles		135	
Hill	12	2 N.	14 E.				
Columbia Basin	11	2 N.	12 E.	Columbia Basin Dev. Co., 652 Monadnock Bldg., San Francisco	2050	37	XIV, p. 166.
Crawford	6, 7	2 N.	15 E.	T. C. Crawford, London, England	2400	420	XIV, p. 167.
	12	2 N.	15 E.				
Crystal Spring	22	2 N.	14 E.	Estate of Mrs. C. McTarnahan, 133 Fulton St., Redwood City		50	VIII, p. 674; X, pp. 737-738.
Darkie	1	1 N.	14 E.	R. L. Price, Sonora			
Dell Bacon, Maud Dell, Good Hope	29, 30	2 N.	16 E.	H. West & A. Scanavino, c/o A. Scanavino, Tuolumne			
Douglasville		2 N.	14 E.	I. S. & Anna May, Columbia, W. J. Luke c/o A. C. Nelson, Columbia, Frank T. Byrd & W. A. Divoll, Sonora, et al.		10	
Duchow	27	2 N.	14 E.	Estate W. A. Duchow, M. C. Duchow, et al., c/o R. Duchow, Sonora		80	
Empire							X, p. 737.

Gold Dredge	35	1 S.	14 E.	C. W. Bates, La Grange		56	
Gold Ship, Gold Grain, Corr Belt	1, 2, 3	1 S.	16 E.	Gold Ship Mining Co., c/o W. J. Graham, Box 247, St., George, Utah	2800	566	XIV, p. 167.
	12	1 S.	16 E.				
Good Return	34	3 N.	14 E.	Columbia Mining Water & Power Co., Larkspur		140	
Hathway	25	2 N.	14 E.	Robert Juka, Sonora			
Hidden Treasure	31	2 N.	16 E.	J. P. Dargitz, Soulsbyville		113	
	6	1 N.	16 E.				
Hoseg, Dick & Kent	32	1 N.	14 E.	Christian Hoseg, Jamestown & Herbert Gaytes, 395 Vernon St., Oakland		206	
Humbug	33	2 N.	14 E.	California Co., 60 State St., Boston Mass.	1700	160	X, pp. 737-738; XIV, p. 167.
Humfield & Myers	10	1 S.	14 E.	Mrs. Minnie H. Morris, c/o Saul Morris, 202 E. Adams St., Stockton		26	
If I Can							See Stanislaus Gravel Nos. 1, 2 and 3.
Jamestown & Comet	4	1 N.	14 E.	Estate of E. C. Sullivan, c/o John Sullivan, Route 1, Sonora		160	
Kibble & Rowell	16	2 N.	16 E.	Millard L. Rowell, Confidence		60	
Knickerbocker Flat							See Yankee Hill.
K. S. S.	20	1 S.	15 E.	Peter M. Shaw, Chinese Camp, ½, L. Marconi, Chinese Camp, ½			
Laura	32	2 N.	16 E.	Estate of John Scanavino, c/o Andrew, Henry & Claude Scanavino, Tuolumne		20	
Marble	1	2 N.	14 E.	Mrs. Ida D. Pettit, 285 Lincoln Ave., Rockville Center, Long Island, N. Y.		40	
Marcovich	13	2 N.	14 E.	Gertrude C. Marcovich, Columbia		18	
Martha Washington							XII, p. 303; XIII, p. 485.
McKinley	17	1 N.	14 E.	Saul Morris, 202 E. Adams St., Stockton		80	
Monarch	4	2 N.	16 E.	Monarch Gravel Mining Co., Jerry Casey, Sec., 510 Page St., San Francisco	4500	320	XVII, p. 486; XX, p. 21.
Monday, Bumble Bee	2	1 N.	13 E.	Calaveras Copper Co., c/o Jos. Sanguinetti, Sonora		220	
Montezuma Tunnel	20	1 N.	14 E.	Geo. S. Montgomery, Beulah Heights, Oakland		120	
Old Home	7	2 N.	15 E.	Juko Baldo, et al.		20	
Oliver	27	1 N.	13 E.	Charles Wagner, Jamestown		320	
Philadelphia Diggings							XII, p. 305; XIII, p. 488.
Punch Bowl	20	1 N.	14 E.	Cecile Shafer, Jamestown	1100	180	XIV, p. 167.
Rawhide, Paducah	4, 5	1 N.	14 E.	Heirs of John Arnold, c/o Mathilde M. Drown, R. 1, Box 421, Meridian Road, San Jose & W. J. Black, Jamestown		240	
Red Gravel							See Colorado.
Red Hill	29	1 N.	14 E.	Mrs. Alexandra Lyon, Sonora		40	
Reservoir	1	2 N.	14 E.	Luigi Paguini, Columbia		55	
Roosevelt-Butter Cup Cons.	20	1 S.	15 E.	Henry W. & Geo. Keith, Chinese Camp		38	

*Ownerships shown in this table are those shown on assessment rolls.

TABLE OF PLACER MINES AND PROSPECTS, TUOLUMNE COUNTY—Continued.

Name of mine	Location			Owner's name and address*	Elevation, feet	Area, acres	Bibliography
	Sec.	Twp.	Range				
Rosedale							See Buckeye.
Rough & Ready	30, 31	1 N.	14 E.	E. Thos. Richards, Sonora & Dennis E. Guerin		209	
	25, 36	1 N.	13 E.				
Salvador	3, 10	1 S.	14 E.	Minnie Morris, c/o Saul Morris, 202 E. Adams St., Stockton & Rosa & D. Lertora, Jamestown		150	
Saratoga	22	2 N.	14 E.	Saratoga Mining Co. c/o P. M. Watkins, 65 Main St., San Francisco	1890	40	X, p. 737; XII, p. 306; XIII, p. 490; XIV, pp. 167-168.
Specimen Gulch, Never Give Up	7	2 N.	15 E.	Suda M. Mapes, Columbia		40	
Springfield	9, 10, 14	2 N.	14 E.	Springfield Tunnel & Dev. Co., c/o Jas. B. Miller Sonora	2300	1198	XIV, p. 168; XVII, pp. 486-487; XVIII, p. 101; XX, pp. 22, 183.
	15, 16	2 N.	14 E.				
	22, 23	2 N.	14 E.				
Spring Hill & Cowan	25	2 N.	14 E.	M. A. Cowan, c/o Mrs. W. H. Rablen, Sonora			
Squabbletown	24	2 N.	14 E.	A. L. Pedro, Columbia		10	
Stanislaus No. 1, 2 and 3	28, 29	1 N.	15 E.	Western King Mining Co., c/o Wm. Kieft, 608 Folsom St., San Francisco	700	590	VIII, p. 575; XIV, p. 168.
Stockton	7, 8, 17	3 N.	16 E.	Stockton Gravel Mining Co., c/o W. C. Ramsey, Record Office, Stockton		542	
	12, 13	3 N.	15 E.				
Sugar Pine	36	3 N.	16 E.	Phil. M. Ryan, Sonora		50	
Sullivan	28	2 N.	15 E.	Mrs. H. Cramer, Sr., 166 Second St., San Jose; E. & C. Bottini, Sonora		300	
Table Mountain, Alpha	9	1 N.	14 E.	J. N. Oliver, Jamestown		92	
Ventura Grubstake Co.	19, 20	1 N.	14 E.	c/o J. J. Habecker, Jamestown		503	
	29	1 N.	14 E.				
Weidikind	36	3 N.	14 E.	Eric Segerstrom, Sonora		20	
White Lead	11	2 N.	14 E.	Miriam Mining Co., c/o Chas. C. Gross, 458 Mills Bldg., San Francisco		10	XI, p. 507; XII, p. 298; XIII, p. 472.
Williamson	14	2 N.	14 E.	Sadie J. Brub, P. O. Box 151, Modesto		20	

*Ownerships shown in this table are those shown on assessment rolls.

GRANODIORITE ('GRANITE').

Two small 'granite' quarries have been operated in the county but both are idle now. The stone is a pleasing bluish gray granodiorite of medium texture.

Phoenix Lake Granite Company, care Western Granite Works, Stockton Ave., San Jose, owns 120 acres in Sec. 23, T. 2 N., R. 15 E., about six miles northeast of Sonora. This property was formerly a producer.

Sonora Granite Company was organized to work a granodiorite deposit on the Rablen Ranch in Sec. 14, T. 1 N., R. 15 E., three miles from the nearest shipping point on the Sierra Railway. Some small buildings were put up and an air compressor and small tools installed. A few carloads of the stone were shipped, but there has been no activity since July, 1923.

GRAPHITE.

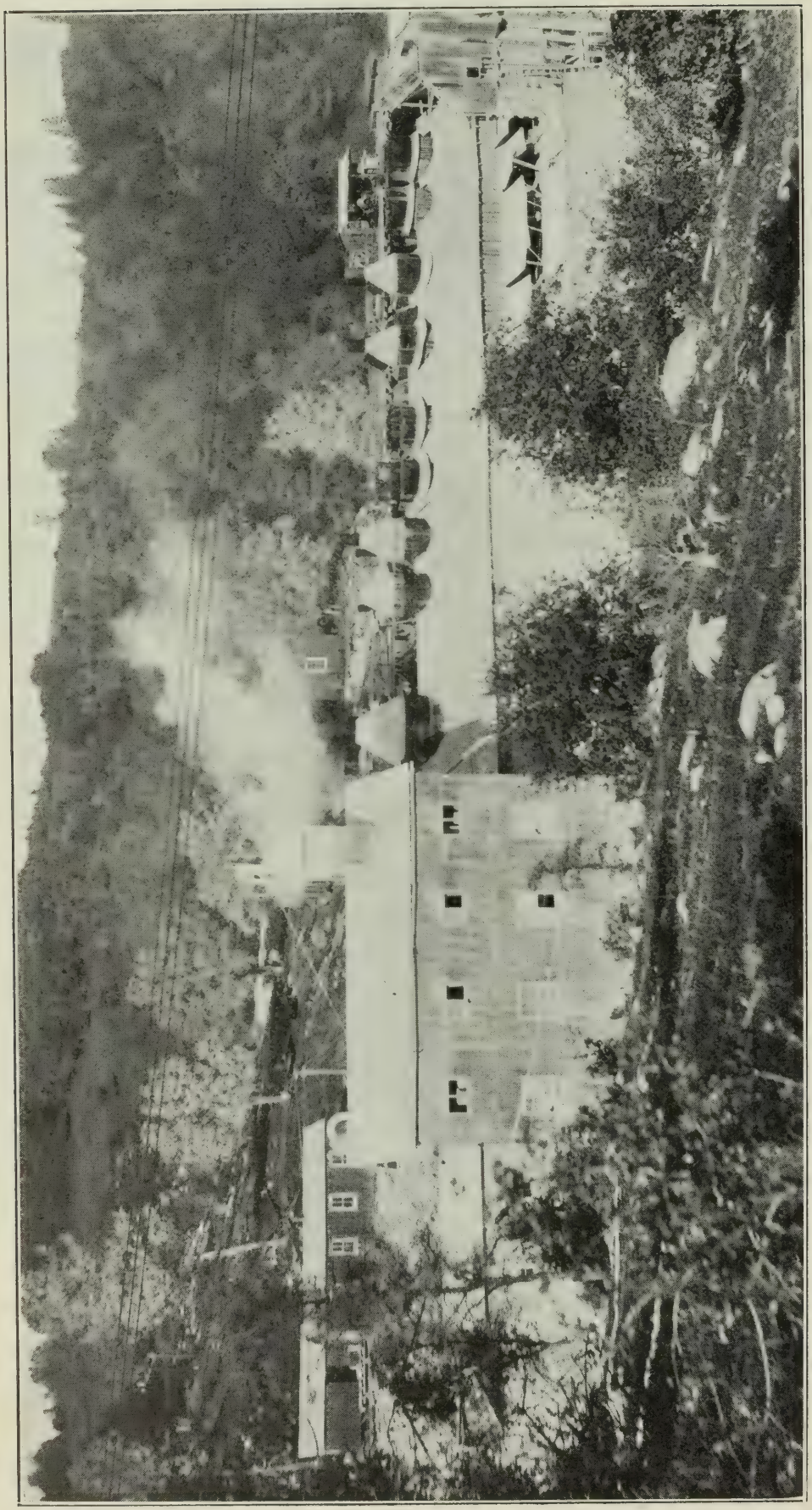
For a few years, beginning in 1865, graphite was mined and shipped from the *Eureka Plumbago Mine* between Columbia and Sonora. The mine was worked by open cuts. Some of the product was sacked as mined, and a part was washed in crude appliances and sun-dried. Chinese labor at $8 a week per man was employed. The product was shipped to England, and the cost laid down at Liverpool was $40 a ton. Owners, A. L. Pedro, Columbia, and others.

Other graphite prospects have been noted at the north end of the town of Sonora and near Gold Springs, four miles north of the Eureka deposit. Among these, some work has been done on the *Morgan Graphite* claim, in Sec. 9, T. 2 N., R. 14 E., about three miles west of Columbia. Owner, M. A. Morgan, care Lon P. Fraser, 3042 College Ave., Berkeley.

LIMESTONE.

The county contains immense deposits of limestone and marble which extend from Tuolumne River 12 miles southeast of Sonora, in a westerly and northerly direction, through Sonora and Columbia to Stanislaus River and beyond into Calaveras County. The principal limestone mining operations have been south of Sonora, where the holdings of several small companies have in late years been consolidated by Pacific Lime and Plaster Company, the only operator there at present. The limestone this company is mining appears to contain less magnesium carbonate than that in the Columbia district, and is a pure, coarsely crystalline white and grey stone. The limestone occurs in the Calaveras (Carboniferous) rocks, and the compression and alteration which these comparatively old rocks have undergone has resulted in changing much of the limestone to marble. The marble was at one time quarried at the Maine and Mississippi properties 7½ miles southeast of Sonora, but later operations have been near Columbia. (See under Marble.) So far as known, the stone does not contain sufficient magnesium to be classed as dolomite, but is, properly speaking, magnesian limestone or magnesian marble.

Pacific Lime and Plaster Company. Main office, 58 Sutter Street, San Francisco. Charles M. Cadman, president; John Mocine, resident manager. L. M. Reith is superintendent of the plant one mile south



Plant of Pacific Lime and Plaster Company near Sonora, Tuolumne County.

of Sonora. The land holdings cover 4000 feet along the southern part of a limestone body which extends for several miles passing through Sonora, striking N. 27° W.

The deposit lies between walls of Calaveras (Carboniferous) rocks, and is cut by a number of igneous dikes. For the most part it is a solid, coarsely crystalline deposit of white and light grey limestone with high calcium and low magnesia content, and with very little silica, alumina and iron oxide. So far as opened, only a few small caverns have been encountered. The intrusive dikes appear to have had little effect on the stone, but may serve as boundaries for work in a few places.

The holdings are a consolidation of several smaller ones where various pits were started by former operators. At present, mining is going on at three places. The north quarry (now worked underground entirely through adits) has been opened for 600 feet along the strike and 91 feet deep, with three levels, two of them adits and the lowest reached by a flat incline. The central workings are 70 feet deep with three levels, and have been opened 750 feet along the strike. No. 2 South workings have been opened for a length of 300 feet north and south and 230 feet east and west.

Limestone is mined by opening wide drifts and rooms, leaving pillars, and by top slicing. Large blocks of stone are broken by sledging or by plugging with jackhammer and blasting. Cars are hoisted from the mines to the plant by electric power. Spalls are kept separate from coarse rock. About 150 tons of limestone is mined daily.

Of the 13 upright kilns, ten were in commission at the time of visit December 1. The limestone is in the kilns for 48 hours and in the fire zone, where the temperature goes as high as 2300° to 2400° F., four hours. The kilns are lined with three courses of Stockton firebrick, and the lining lasts 10 to 15 months. From 70 to 80 tons of lime is produced daily. Lump and ground lime are marketed under the trade name 'Acme.'

In the lime hydrate plant, charges of 1200 pounds of crushed lime and 840 pounds of water are mixed 15 minutes and the hydrate is passed through a worm, ground in a Raymond mill and air separated and stored in bins from which it is drawn and bagged. Sierra brand hydrate, the best grade, carries only 1½% to 2% MgO; 99.7% is claimed to pass 100-mesh and 98% to pass 200-mesh. Longspred brand hydrate is slightly coarser, and carries up to 4½% MgO. Eclipse brand is used for cyanide work and for agricultural purposes.

Ground lime, pulverized to 20-mesh, is produced to supply a demand for a quick-slaking lime.

Crushed lime, 1-inch size and smaller, is supplied principally for export. It is shipped in 90-lb. carbide cans to Pacific coast and island ports.

Spalls from the mines are crushed and ground in a hammer mill to 20-mesh, supplying a few users of ground limestone.

Golden Gate-Atlas Materials Company, a separate company, produces mortar from lime made at this plant.

At present 80 men are employed.

MAGNESITE.

Magnesite occurs in the serpentine area in the vicinity of Chinese Camp, and some work has been done on several groups of claims. These have been described in Bulletin 79, 'Magnesite in California'.* All of the claims have remained idle since that was written, and are so at this time.

Gray Eagle Magnesite Co., care Hamilton, Beauchamp and Woodworth, 564 Market St., San Francisco, has a calcining plant (now idle) at Chinese station on the Sierra Railway. Some ore was mined from the *Gray Eagle* claim in Sec. 16, T. 1 S., R. 14 E., two miles from the plant and calcined in this plant. A depth of 98 feet was reached in the mine by adit workings, and a vein eight to ten feet wide was reported. The ore assayed 95% $MgCO_3$.

Monarch and Mackey claims were prospects a mile and a mile and a half, respectively, from Chinese Camp.

White Rock Magnesite Mine is in SW¼ of Sec. 6, T. 1 S., R. 14 E. A vein one to two feet wide was prospected by an inclined shaft 60 feet deep, and by short surface cuts at intervals for 1000 feet. Three cars of ore were shipped in 1917, but the claim is idle now.

MARBLE.

Marble at one time was quarried 7½ miles south of Sonora, but later operations have been in the large area surrounding Columbia, extending north and northeast of that town into Calaveras County, and having a width of two to four miles. The stone varies from pure white through various degrees of veining to dark grey. It is harder and has a higher specific gravity than many marbles. Its compressive strength is reported to be from 20,000 to 25,000 lb. per cubic inch, which is much higher than that of varieties with which it competes. For a dolomitic stone, it is also fine grained. The magnesium carbonate content runs from 16% to 27% and the silica, alumina and iron oxide contents are very low. The exact depth of the deposits has not been determined, but the deepest shaft in the area, at the Experimental Mine, is 586 feet deep (incline) or over 400 feet vertically, and in limestone. The North Fork of Stanislaus River has also cut a canyon which is 1150 feet lower than Columbia, and entirely in the limestone. Columbia Marble Quarry is the only one now active. Other quarries are the *Bell*, at Columbia, the *Baxter* and *Sonora* quarries between Sonora and Columbia and the *Warren* quarry 3½ miles northwest of Columbia.

Bell Columbia Marble Company. Office, 114 Sansome St., San Francisco. Property consists of 45 acres covering part of the large dolomitic marble area of Columbia, at the east side of that town. It is five miles by good road from Sonora. Quarrying of marble began in December, 1918, and continued at intervals for several years, but no work has been done for over a year past. There is considerable equipment, including derricks, air compressors, etc., the improvements bearing an assessed valuation of $38,000.

This company found itself hampered in marketing its marble because

* Calif. State Min. Bur. 1925.

of the lack of a sawing plant and polishing equipment and has l
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G. Bordoli & Bros., Box 513, Sonora, operate a small quarry be
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in a rockbreaker to about one-inch size and is shipped for use in terra



View of Marble Quarry of Columbia Marble Company, Tuolumne County.

Columbia Marble Company. Main office, 413 Rialto Building,
Francisco. H. R. Van Norden, secretary. The quarry is $2\frac{3}{4}$ m
northeast of Columbia, and on the south side of Stanislaus River, 1
feet from the old quarry which supplied so much marble. H. J. To
Sonora, manager, and W. D. Bannister, superintendent.

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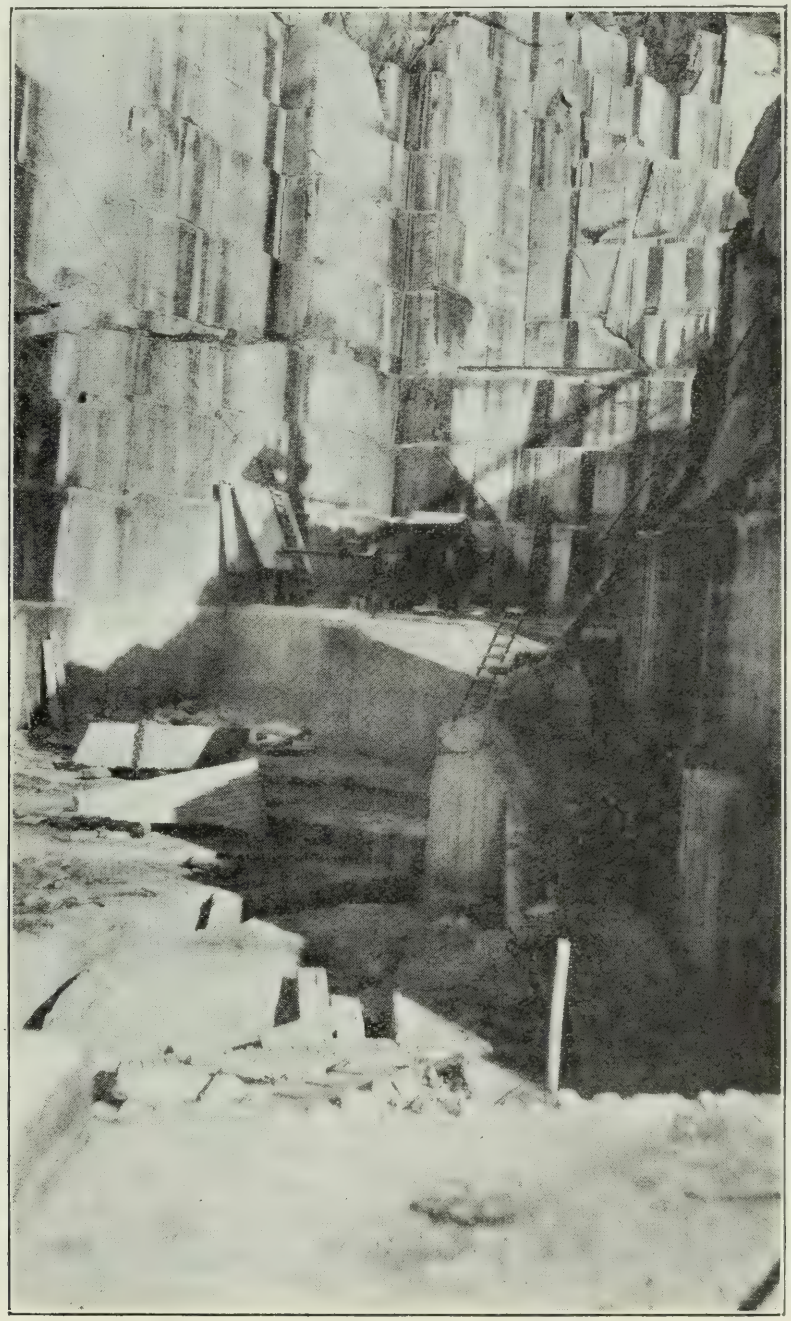
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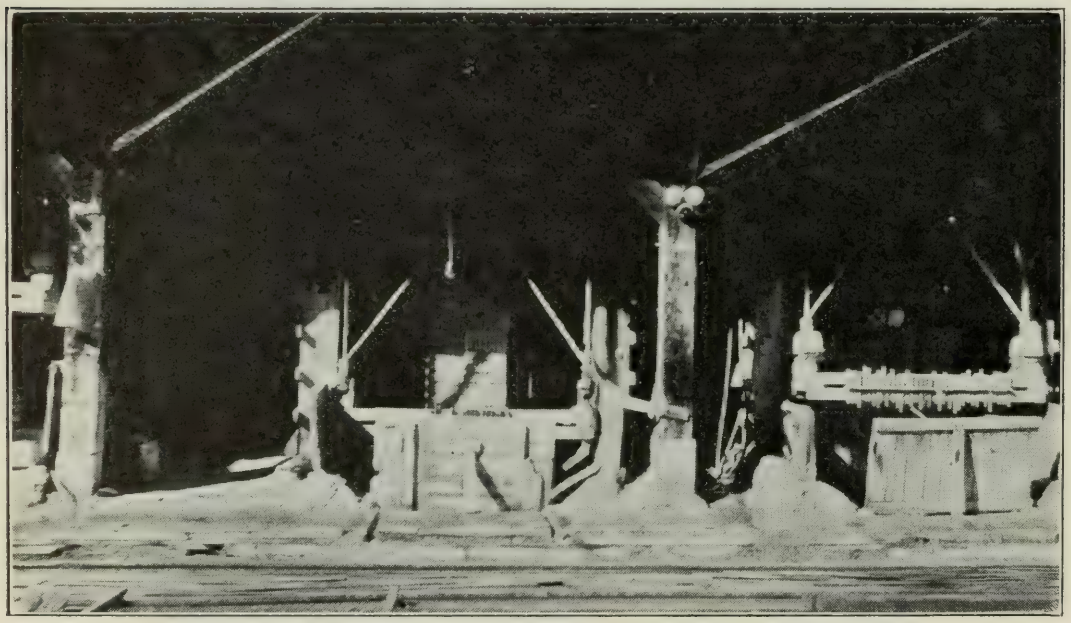
View of Marble Quarry of Columbia Marble Company, Tuolumne County.

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The stone is a handsome and durable dolomitic marble. The principal product is white with blue veining, although other shades, including a beautiful buff stone with reddish veining, called Portola marble, have been quarried. The new pit was opened in 1921 and its situation on the steep slope permits easy drainage and disposal of waste. The



View of Pit of Columbia Marble Company, showing channelling machine in operation.



Gangsaws at Columbia Marble Company's Plant, sawing marble blocks.

marble deposit is 200 feet wide, 500 feet deep and a mile long, and has been estimated to contain over 200,000,000 cubic feet, being part of an immense deposit covering many square miles. The company owns 160 acres.

The channeling machines cut blocks of marble 16 by 12 feet. A row of holes is then drilled horizontally along the bottom of the block which

is broken out by wedges and feathers. The large blocks are then split again into pieces weighing about seven tons each, which are loaded by derrick and hoisted up the inclined track to the gangsaws, which are 1100 feet distant and 250 feet above the quarry. The quarry equipment includes two channeling machines, two electrically operated derricks, two air compressors each operated by a 75-h.p electric motor, and air drills and shop.

There are eight gangsaws, some with 25 saws each. These use steel balls for sawing and cut at the rate of one-fourth inch an hour, requiring about a week to saw through a block. The slabs from the saw are trimmed with an air chisel and go to the rubbing bed. This is of cast iron, 12 feet in diameter, four inches thick and weighs nine tons. It turns 45 to 50 times a minute. The slabs, which are $1\frac{1}{4}''$ thick, are trued up on this bed to exact dimensions, and the rubbing is a sufficient finish for flooring, steps and the like. Monterey sand is used.

Thirty men are employed. Marble is hauled by tractors or trucks to the Sierra Railway at Sonora, a distance of seven miles.

SOAPSTONE AND TALC.

B. Brown, Box 332, Sonora; *W. E. Finch,* Box 583, Sonora; and *A. D. Hunter,* Box 584, Sonora, have all listed deposits of soapstone and talc for sale.

H. Favot, Moccasin P. O., has a large deposit of soapstone and talc about two miles from Hetch Hetchy Railroad in the Moccasin district. It is only slightly developed.

SAN FRANCISCO FIELD DIVISION.

C. McK. Laizure, Mining Engineer.

On account of unfinished field work there is no report from the San Francisco Field Division in this issue.

LOS ANGELES FIELD DIVISION.

W. Burling Tucker, Mining Engineer.

On account of unfinished field work there is no report from the Los Angeles Field Division in this issue.

OIL FIELD DEVELOPMENT OPERATIONS.

By R. D. Bush, State Oil and Gas Supervisor.

From October 2, 1927, to and including December 31, 1927, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
ALAMEDA COUNTY:					
Livermore Shallow Fields Drilling Co.	22	3	3	1	----------
FRESNO COUNTY:					
Standard Oil Co.	5	21	15	8	Coalinga
Superior Oil Co.	18	21	17	Kennedy 1	----------
KERN COUNTY:					
Carneros Oil Co.	31	28	21	13	Belridge
Carneros Oil Co.	30	28	21	48	Belridge
Carneros Oil Co.	30	28	21	83	Belridge
Carneros Oil Co.	30	28	21	84	Belridge
Hugh Porter	36	28	20	1	Belridge
Bishop Corporation	23	28	27	4	Kern River
Bishop Corporation	23	28	27	5	Kern River
California Petroleum Corp.	26	28	27	Cole 1	Kern River
California Petroleum Corp.	23	28	27	Lehmann 2	Kern River
California Petroleum Corp.	23	28	27	Lehmann 3	Kern River
California Petroleum Corp.	23	28	27	Lehmann 4	Kern River
C. C. M. O. Co.	23	28	27	10	Kern River
C. C. M. O. Co.	23	28	27	12	Kern River
C. C. M. O. Co.	23	28	27	13	Kern River
C. C. M. O. Co.	23	28	27	14	Kern River
General Petroleum Corp.	14	28	27	20	Kern River
General Petroleum Corp.	26	28	27	Sill 14	Kern River
General Petroleum Corp.	26	28	27	Sill 15	Kern River
General Petroleum Corp.	26	28	27	Sill 16	Kern River
General Petroleum Corp.	26	28	27	Sill 30	Kern River
General Petroleum Corp.	26	28	27	Sill 36	Kern River
General Petroleum Corp.	14	28	27	Wetmore 6	Kern River
General Petroleum Corp.	14	28	27	Wetmore 7	Kern River
George F. Getty, Inc.	26	28	27	Grady 7	Kern River
George F. Getty, Inc.	26	28	27	Lightner 1	Kern River
George F. Getty, Inc.	26	28	27	McDougall 1	Kern River
George F. Getty, Inc.	26	28	27	McDougall 2	Kern River
George F. Getty, Inc.	26	28	27	McDougall 8	Kern River
Kent & Whittier	26	28	27	2	Kern River
The Kern River Oilfields of Cal. Ltd.	26	28	27	3	Kern River
The Kern River Oilfields of Cal., Ltd.	26	28	27	10	Kern River
Petroleum Securities Co.	22	28	27	2-B	Kern River
Petroleum Securities Co.	22	28	27	3-B	Kern River
Petroleum Securities Co.	22	28	27	6	Kern River
Petroleum Securities Co.	22	28	27	7	Kern River
Petroleum Securities Co.	22	28	27	8	Kern River
Petroleum Securities Co.	22	28	27	9	Kern River
The St. Helens Petroleum Co., Ltd.	26	28	27	2	Kern River
Standard Oil Co.	21	28	27	3	Kern River
Standard Oil Co.	27	28	27	13	Kern River
Standard Oil Co.	27	28	27	15	Kern River
Standard Oil Co.	15	28	27	17	Kern River
Standard Oil Co.	15	28	27	18	Kern River
Standard Oil Co.	15	28	27	19	Kern River
Standard Oil Co.	15	28	27	20	Kern River
Union Oil Co.	28	27	28	Tribe 1	Kern River
Wonder Co., Ltd.	23	28	27	3	Kern River
Keefe-Morrison, Inc.	8	30	22	7	McKittrick
Honolulu Consolidated Oil Co.	8	32	24	2	Midway
North American Oil Consolidated	32	31	24	13	Midway
Standard Oil Co.	3	32	24	35	Midway
Standard Oil Co.	29	31	24	51	Midway

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued.					
Standard Oil Co.	19	31	24	92	Midway
Standard Oil Co.	19	31	24	99	Midway
Standard Oil Co.	33	31	24	106	Midway
Western Production Co.	21	31	22	11	Midway
A. Bruce Frame	18	26	28	Domion 1	Mt. Poso
General Petroleum Corp.	21	27	28	Glide 21 1	Mt. Poso
Superior Oil Co.	11	26	27	Smith 1	Mt. Poso
Exeter Oil Co.	1	29	20	Parry 1	Temblor
R. B. Jackson & C. H. Chamberlan	36	29	20	1	Temblor
Herbert Moore	11	29	20	1	Temblor
Selegna Investment Co.	36	29	20	Selegna 1	Temblor
Standard Oil Co.	27	11	20	Kern Co. Lease No. 2 31	Wheeler Ridge
Standard Oil Co.	27	11	20	Kern Co. Lease No. 2 32	Wheeler Ridge
Associated Oil Co.	34	28	29	Harvey 1	----------
Brown-Hammond Oil & Tool Co.	14	11	9	1	----------
California Petroleum Corp.	26	27	28	Glide 1	----------
Pearl Durnal	32	27	29	1	----------
Elbe Oil Land Development Co.	20	28	29	1	----------
Midway Northern Oil Co.	29	29	30	Brown 1	----------
Milham Exploration Co.	8	28	23	2	----------
Selegna Investment Co.	9	11	24	1	----------
Shell Co.	29	28	29	Jewett 1	----------
KINGS COUNTY:					
Monocline Development Co.	7	21	21	1	----------
LOS ANGELES COUNTY:					
Brownmoor Oil Co.	7	2	14	8	Inglewood
Standard Oil Co.	17	2	14	Baldwin-Cienega 55	Inglewood
Standard Oil Co.	17	2	14	Baldwin-Cienega 63	Inglewood
Bellview Oil Syndicate	29	4	12	1	Long Beach
Biltmore Petroleum Corp.	29	4	12	1	Long Beach
Bolsa Chica Oil Corp.	30	4	12	Mutual 4	Long Beach
Bush-Voorhis Oil Co.	19	4	12	22	Long Beach
California Eastern Oil Co.	29	4	12	E. B. Campbell 1	Long Beach
California Eastern Oil Co.	29	4	12	Paulsen 1	Long Beach
California Petroleum Corp.	29	4	12	Brown 3	Long Beach
California Petroleum Corp.	19	4	12	Davidson 7	Long Beach
California Petroleum Corp.	19	4	12	Davidson 8	Long Beach
California Petroleum Corp.	29	4	12	Ellis 2	Long Beach
California Petroleum Corp.	29	4	12	Flower State 2	Long Beach
California Petroleum Corp.	29	4	12	Griswold One 2	Long Beach
California Petroleum Corp.	19	4	12	Harlow 9	Long Beach
California Petroleum Corp.	19	4	12	Lewis 2	Long Beach
California Petroleum Corp.	29	4	12	McDavid 3	Long Beach
California Petroleum Corp.	19	4	12	Neece 3	Long Beach
California Petroleum Corp.	30	4	12	Reedy DuBois 2	Long Beach
California Petroleum Corp.	29	4	12	Robinson 4	Long Beach
California Petroleum Corp.	30	4	12	Shilling 4	Long Beach
California Western Oil Co.	19	4	12	Darby 3	Long Beach
California Western Oil Co.	19	4	12	Darby 4	Long Beach
E. B. Campbell	29	4	12	3	Long Beach
E. B. Campbell	29	4	12	4	Long Beach
Tom J. Cannon	29	4	12	Jones 2	Long Beach
Continental Oil Co.	19	4	12	Modoc 1	Long Beach
Continental Oil Co.	19	4	12	Taylor 1	Long Beach
Crown City Oil Co.	29	4	12	2	Long Beach
Dabney-Johnston Oil Corp.	30	4	12	4	Long Beach
Delaney Petroleum Corp.	19	4	12	Alsop 1	Long Beach
Delaney Petroleum Corp.	19	4	12	Harlow 2	Long Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
Delaney Petroleum Corp.	29	4	12	Hart 1	Long Beach
L. T. Edwards	28	4	12	Bradley 1	Long Beach
L. T. Edwards	30	4	12	Brayton 2	Long Beach
L. T. Edwards	30	4	12	Brayton 3	Long Beach
Freeman Oil Syndicate	29	4	12	1	Long Beach
General Petroleum Corp.	19	4	12	Black & Drake 3	Long Beach
General Petroleum Corp.	19	4	12	Clock 4	Long Beach
General Petroleum Corp.	19	4	12	Jonah 5	Long Beach
General Petroleum Corp.	19	4	12	K & H 8	Long Beach
General Petroleum Corp.	19	4	12	Signal 2	Long Beach
George F. Getty, Inc.	30	4	12	L. B. 17	Long Beach
George F. Getty, Inc.	30	4	12	L. B. 17	Long Beach
George F. Getty, Inc. and J. Paul Getty	19	4	12	L. B. 21	Long Beach
George F. Getty, Inc. and J. Paul Getty	19	4	12	L. B. 22	Long Beach
George F. Getty, Inc. and J. Paul Getty	19	4	12	L. B. 23	Long Beach
George F. Getty, Inc. and J. Paul Getty	20	4	12	L. B. 24	Long Beach
Graham-Loftus Oil Co.	19	4	12	Mack 1	Long Beach
Herndon Petroleum Corp.	28	4	12	Herndon 4	Long Beach
Herndon Petroleum Corp.	29	4	12	Herndon 5	Long Beach
A. T. Jergins Syndicate, Inc.	29	4	12	3	Long Beach
A. T. Jergins Trust	19	4	12	22	Long Beach
A. T. Jergins Trust	19	4	12	23	Long Beach
A. S. Johnston Drilling Corp.	30	4	12	3	Long Beach
A. S. Johnston Drilling Corp.	30	4	12	6	Long Beach
Marine Corp.	19	4	12	28-A	Long Beach
McKeon Drilling Co., Inc.	30	4	12	Ellis 1	Long Beach
McKeon Drilling Co., Inc.	29	4	12	Macrate 1	Long Beach
McKeon Drilling Co., Inc.	30	4	12	Thorne 1	Long Beach
Miley Oil Co.	30	4	12	Miley-Dabney 1	Long Beach
J. E. O'Donnell	29	4	12	O'Donnell 62	Long Beach
J. E. O'Donnell	29	4	12	O'Donnell 63	Long Beach
J. E. O'Donnell	29	4	12	O'Donnell 64	Long Beach
J. E. O'Donnell	29	4	12	O'Donnell 65	Long Beach
Pan American Petroleum Co.	30	4	12	Chainey 4	Long Beach
Pan American Petroleum Co.	29	4	12	McKeon 3	Long Beach
Rainbow Petroleum Co.	29	4	12	12	Long Beach
Richfield Oil Co.	29	4	12	Denni 6	Long Beach
Richfield Oil Co.	29	4	12	Green 4	Long Beach
Richfield Oil Co.	29	4	12	Green 5	Long Beach
Richfield Oil Co.	29	4	12	Green 6	Long Beach
Richfield Oil Co.	30	4	12	Hass 15	Long Beach
Richfield Oil Co.	30	4	12	Hass 16	Long Beach
Richfield Oil Co.	30	4	12	Hass 17	Long Beach
Richfield Oil Co.	29	4	12	Monrovia 3	Long Beach
Richfield Oil Co.	29	4	12	Warren & Macrate 4	Long Beach
Rio Grande Oil Co.	29	4	12	A-3	Long Beach
Rio Grande Oil Co.	29	4	12	Flower State 2	Long Beach
Shell Co.	29	4	12	Alamitos 25	Long Beach
Shell Co.	29	4	12	Alamitos 26	Long Beach
Shell Co.	29	4	12	Alamitos 27	Long Beach
Shell Co.	29	4	12	Alamitos 28	Long Beach
Shell Co.	29	4	12	Alamitos 29	Long Beach
Shell Co.	29	4	12	Alamitos 30	Long Beach
Shell Co.	29	4	12	Alamitos 31	Long Beach
Shell Co.	29	4	12	Alamitos 32	Long Beach
Shell Co.	29	4	12	Binkley 3	Long Beach
Shell Co.	29	4	12	Hutton Comm. 7	Long Beach
Shell Co.	29	4	12	Martin Comm. 4	Long Beach
Shell Co.	29	4	12	Nesa 7	Long Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
Shell Co.	29	4	12	Patton-Wilson 5	Long Beach
Signal Syndicate No. 4	19	4	12	7	Long Beach
The State Co., Inc.	30	4	12	1	Long Beach
Superior Oil Co.	19	4	12	Britton 3	Long Beach
Superior Oil Co.	19	4	12	Britton 4	Long Beach
Superior Oil Co.	29	4	12	Crew 3	Long Beach
Superior Oil Co.	29	4	12	Crew 4	Long Beach
Superior Oil Co.	29	4	12	Harlan 2	Long Beach
Travis Drilling Co.	30	4	12	Sales 2	Long Beach
Travis Drilling Co.	29	4	12	Travis 2	Long Beach
Union Oil Co.	30	4	12	Long Beach Comm. 16	Long Beach
Union Oil Co.	30	4	12	Long Beach Comm. 17	Long Beach
Union Oil Co.	30	4	12	Long Beach Comm. 18	Long Beach
Union Oil Co.	30	4	12	Long Beach Comm. 20	Long Beach
Universal Consolidated Oil Co.	29	4	12	Graham 1	Long Beach
Universal Consolidated Oil Co.	29	4	12	Stoll 1	Long Beach
V. R. G. Wilbur	19	4	12	Bergstrom 2	Long Beach
St. Helens-Riverside Properties	2	2	12	Monterey 16	Montebello
Standard Oil Co.	2	2	12	Benedictine 2	Montebello
Union Oil Co.	17	3	13	Padelford 4	Rosecrans
George F. Getty, Inc.	14	5	12	S. B. 15	Seal Beach
Standard Oil Co.	3	5	12	San Gabriel 16	Seal Beach
Union Drilling & Petroleum Co.	3	5	12	Thompson 1	Seal Beach
White Oil Co.	3	5	12	1	Seal Beach
C. C. M. O. Co.	10	4	14	Torrance 91	Torrance
Otis G. Andrews & Sons	28	8	13	1	----------
Associated Oil Co.	13	2	12	Patterson 1	----------
A. A. Craig	11	3	13	1	----------
Hurst Oil Corp.	28	2	14	Simons 1	----------
James Mayzie	20	5	17	1	----------
ORANGE COUNTY:					
Brea Canon Oil Co.	1	3	10	43	Brea-Olinda
Union Oil Co.	1	3	10	Stearns 71	Brea-Olinda
Chiksan Oil Co.	19	3	9	Yorba 1	Coyote Hills
Holly Development Co.	20	3	9	Lehmer 1	Coyote Hills
Shell Co.	22	3	10	Stern 1 1	Coyote Hills
Abel, Rosenberg & Lowis	10	6	11	1	Huntington Beach
Beil of Montebello Oil Co.	2	6	11	7	Huntington Beach
F. W. Bishop	10	6	11	1	Huntington Beach
Allen Brown	10	6	11	4	Huntington Beach
California Petroleum Corp.	27	5	11	Buck 8	Huntington Beach
California Petroleum Corp.	10	6	11	Fee 4	Huntington Beach
A. G. Deck	10	6	11	Deck 1	Huntington Beach
Deck-Camp No. 1	10	6	11	1	Huntington Beach
Duel Petroleum Co.	36	5	11	1	Huntington Beach
Duncan & Lea Petroleum Corp.	10	6	11	3	Huntington Beach
Dunn-Christensen	10	6	11	Dunn-Christensen 1	Huntington Beach
E. A. Fennell Co., Inc.	10	6	11	2-A	Huntington Beach
J. F. Garliepp	10	6	11	Andrews 2	Huntington Beach
F. E. Hurley	34	5	11	Slater 1	Huntington Beach
C. L. Hussey	10	6	11	2	Huntington Beach
S. W. Lea	10	6	11	2	Huntington Beach
Loftin Oil Co.	10	6	11	3	Huntington Beach
M. W. McVey	10	6	11	McVey 2	Huntington Beach
Miller Oil Co.	10	6	11	Community 1	Huntington Beach
Miller & Van Alen	10	6	11	Miller-Van Alen 1	Huntington Beach
John Morris	10	6	11	1	Huntington Beach
Ben F. Mun	10	6	11	Mun 3	Huntington Beach
Ben F. Mun	10	6	11	Mun 4	Huntington Beach
Ben F. Mun	10	6	11	Mun 6	Huntington Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
ORANGE COUNTY—Continued.					
Ben F. Mun	10	6	11	Mun 7	Huntington Beach
Ben F. Mun	10	6	11	Mun 8	Huntington Beach
Ben F. Mun	10	6	11	Mun 9	Huntington Beach
Ben F. Mun	10	6	11	Mun 10	Huntington Beach
Pacific Coast Oil Co.	10	6	11	Lippencall 1	Huntington Beach
Paul and Collier	10	6	11	1	Huntington Beach
M. J. Pettijohn	10	6	11	1	Huntington Beach
Frank Sanders	10	6	11	1	Huntington Beach
Standard Oil Co.	34	5	11	Bolsa 32	HuntingtonBeach
Standard Oil Co.	34	5	11	Bolsa 33	Huntington Beach
Standard Oil Co.	4	6	11	Huntington Beach 60	Huntington Beach
Western Drilling & Producing Co.	10	6	11	Humphrey's 1	Huntington Beach
Western Ibbetson	10	6	11	Western Ibbetson 22	Huntington Beach
Sy Wicker	10	6	11	Bundy 3	Huntington Beach
Interstate Oil Corp.	17	6	10	Norris 1-A	Newport
Mesa Petroleum Corp.	21	6	10	B. & G. 1	Newport
Petroleum Securities Co.	3	6	10	Fairview 1	Newport
Standard Oil Co.	34	3	9	R. Locke 2	Richfield
Standard Oil Co.	34	3	9	L. Vejar 3	Richfield
Union Oil Co.	33	3	9	Stern 5	Richfield
Union Oil Co.	33	3	9	Stern 12	Richfield
Union Oil Co.	34	3	9	Yorba Linda Group 17	Richfield
SAN BERNARDINO COUNTY					
J. W. McPhearson	25	1	2	1	----------
L. B. Riggins	6	3	7	1	----------
SAN DIEGO COUNTY:					
Davenport Oil & Gas Development Co.	----	12	2	1	----------
Mills Oil Co.	Pueblo	Lot 1	316	1	----------
Stanley S. Turner	Rinc	on del	Diablo		
		12	2	1	----------
SAN LUIS OBISPO COUNTY:					
Miley Oil Co.	15	29	17	1	----------
Union Oil Co.	34	32	15	Rust 1	----------
SAN MATEO COUNTY:					
Morris Schwartz	19	9	4	1	----------
SANTA BARBARA COUNTY:					
George A. Gorham	33	10	34	Gorham 1	Casmalia
Magenheimer Securities Corp.	30	9	32	1	Cat Canyon
Palmer Union Oil Co.	30	9	32	Stendel 14	Cat Canyon
R. & G. Oil Co.	32	9	32	1	Cat Canyon
R. & G. Oil Co.	30	9	32	7	Cat Canyon
Barnsdall Oil Co.	1	4	30	Edwards 2	Goleta
Santa Barbara Oil Co.	2	4	29	Ellwood 1	Goleta
Santa Barbara Oil Co.	3	4	29	Hollister 6-A	Goleta
Santa Barbara Oil Co.	3	4	29	Hollister 3-B	Goleta
H. M. Gilliam	2	4	28	1	----------
Tepusquet Oil Co.	----	9	32	1	----------
The Twin State Oil Co.	----	4	27	1	----------
SANTA CLARA COUNTY:					
Continental Oil Co.	11	11	4	2	----------
SONOMA COUNTY:					
Mortara Oil Co.	8	9	8	1	----------
Shell Co.	----	5	6	Mossi 1	----------
VENTURA COUNTY:					
J. W. Hackworth	11	4	23	Herbert Tareyton 1	Ojai
Continental Oil Co.	36	4	18	4	Piru
W. H. Geis	36	4	18	3	Piru
J. B. Hedrick	33	4	18	1-A	Piru

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
VENTURA COUNTY—Continued.					
Robert B. Moran	2	4	19	1	Piru
Schell & Jennings	32	4	18	11	Piru
C. C. M. O. Co.	17	3	24	Hobson C-1	Rincon
C. C. M. O. Co.	17	3	24	Hobson C-2	Rincon
C. C. M. O. Co.	17	3	24	Hobson C-3	Rincon
C. C. M. O. Co.	17	3	24	Hobson C-4	Rincon
General Petroleum Corp.	8	3	24	Hobson A-1	Rincon
General Petroleum Corp.	8	3	24	Tomson 1	Rincon
E. J. Miley	17	3	24	Henry & Hamilton 1	Rincon
E. J. Miley	17	3	24	Henry & Hamilton 2	Rincon
E. J. Miley	17	3	24	Henry & Hamilton 3	Rincon
Pan American Petroleum Co.	17	3	24	Hobson Fee 1	Rincon
Pan American Petroleum Co.	17	3	24	Hobson Fee 2	Rincon
Pan American Petroleum Co.	17	3	24	Hobson Fee 3	Rincon
Pan American Petroleum Co.	8	3	24	Hobson Fee 4	Rincon
Pan American Petroleum Co.	17	3	24	State 2	Rincon
Petroleum Exploration Co.	17	3	24	1	Rincon
Southern Pacific Land Co.	17	3	24	1	Rincon
Ellis Lockwood & Howard Barmore	1	4	20	6	Sespe
Superior Oil Co.	33	4	20	Sespe 1	Sespe
Shell Co.	6	2	18	Strathearn 1	Simi
Oak Ridge Oil Co.	13	3	21	Harvey 22	South Mountain
Oak Ridge Oil Co.	18	3	20	Willard 25	South Mountain
Union Oil Co.	13	3	21	Caldwell & Snyder 2	South Mountain
Associated Oil Co.	22	3	23	Hartman 11	Ventura
Associated Oil Co.	27	3	23	Lloyd 24	Ventura
Associated Oil Co.	22	3	23	Lloyd 35	Ventura
Associated Oil Co.	27	3	23	Lloyd 52	Ventura
Associated Oil Co.	23	3	23	Lloyd 100	Ventura
Associated Oil Co.	23	3	23	V. L. & W. 3	Ventura
Associated Oil Co.	23	3	23	V. L. & W. 4	Ventura
Associated Oil Co.	26	3	23	V. L. & W. 5	Ventura
M. K. T. Oil Co.	28	3	23	Foster 1	Ventura
Petroleum Securities Co.	28	3	23	Orton 6	Ventura
Petroleum Securities Co.	28	3	23	Orton 7	Ventura
Shell Co.	28	3	23	Edison 20	Ventura
Shell Co.	28	3	23	Edison 21	Ventura
Shell Co.	28	3	23	Edison 22	Ventura
Shell Co.	28	3	23	Edison 23	Ventura
Shell Co.	28	3	23	Taylor 25	Ventura
Shell Co.	28	3	23	Taylor 26	Ventura
Star Petroleum Co.	13	3	23	Star-Canet 1-A	Ventura
Freres & Miller	11	1	20	Conejo 1	----------
Standard Oil Co.	15	2	22	Saticoy-Citrus 1	----------
Standard Oil Co.	15	2	22	Saticoy-Citrus 2	----------

ADMINISTRATIVE DIVISION.

WALTER W. BRADLEY, Deputy State Mineralogist.

Personnel.

There have been no changes of personnel to be noted during the past quarter.

New Publications.

During the quarterly period covered by this issue, the following publications of the Division of Mines and Mining have been made available for distribution:

Bulletin No.100, "California Mineral Production for 1926," by Walter W. Bradley, 175 pages, illustrated with 7 half-tones and 7 line-cuts (maps and charts). Distributed without charge.

Summary of Operations, California Oil Fields, Vol. 12, No. 12, June, 1927; and Vol. 13, Nos. 1 and 2, July and August, 1927, respectively. These contain articles on: 'Recent Developpments in the Huntington Beach Oil Field'; 'Some Improvements in Fishing Tools and Devices used in Rotary Drilling'; 'Production Statistics of California Oil Fields, and Directory of California Oil Operators,' respectively.

Commercial Mineral Notes; Nos. 56, 57, 58, November, December, 1927 and January, 1928, respectively. These 'notes' carry the lists of 'mineral deposits wanted' and 'minerals for sale' issued in the form of a mimeographed sheet monthly. It is mailed free to those on the mailing list for 'Mining in California.'

Mails and Files.

The Division of Mines maintains, in addition to its correspondence files and the library, a mine file which includes original reports on the various mines and mineral properties of all kinds in California.

During each quarterly period there are several thousand letters received and answered at the San Francisco office alone, covering almost every phase of prospecting, mining, and developing mineral deposits, reduction problems, marketing of refined products, and mining law. In addition to this, hundreds of oral questions are answered daily both at the main office and the district offices, for the many inquirers who come in for personal interviews and to consult the files and library.

DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum, Laboratory.

WALTER W. BRADLEY, Deputy State Mineralogist.

CALIFORNIA'S MINERAL PRODUCTION IN 1927.

Estimate of 1927 Output.

The total value of the mineral production of California for the year 1927 just closed, is conservatively estimated by the statistical division to have been approximately $377,205,000. This is, in part, detailed in the tabulation below; but, as there are more than fifty mineral substances on California's commercial list, it is impracticable at this early date to obtain definite figures on other than the more important items. The blank report forms are being mailed to the operators in all mineral lines, and the date of publication of the final detailed and complete report will depend upon the promptness of their replies.

The estimated total of $377,205,000 is a decrease of approximately $73,000,000 from the value of the 1926 production which was the highest total on record for any year in the state. The drop is due mainly to petroleum, and in smaller measure to copper, zinc, silver, and lead. Although there was an increase of approximately 6,000,000 barrels in the quantity of crude oil, the total value will probably show around $65,000,000 less, owing to a sharp cut in the prices effective April 16, 1927, particularly on the grades above 20° Baumé. In the case of crudes above 40° Baumé in the Athens-Rosecrans-Dominguez fields the cut amounted to 50% of the previous price. Around 85% of the crude oil at present produced in California is above 20° B., some testing as high as 50° B.; while the low-grade ranges down to 9° B. Current prices range from 75¢ per barrel for 14°–20° crude in the San Joaquin Valley fields to $1.36 for 43° crude in the Athens-Rosecrans-Dominguez section.

Receipts of bullion at the mint and smelters show a decrease in gold yield of about $200,000 compared with 1926, the drop being chargeable to the lode mines, as the dredges bettered their output of the previous year. The drop in silver yield is due to smaller shipments of copper, lead, and zinc ores. There was an increased output of about 1500 flasks of quicksilver, and the average price was $117 compared with $87.64 in 1926, quotations closing the year at $128 per flask.

Among the structural, industrial and saline groups there were no notable changes to report, with the possible exception of magnesite which showed a smaller quantity shipped, but with unit prices practically stationary.

The estimated quantities and values for 1927 are as follows:

$11,710,000	gold.
890,000	(1,570,000 fine oz.) silver.
3,475,000	(26,800,000 lbs.) copper.
172,000	(2,540,000 lbs.) lead.
518,000	(8,250,000 lbs.) zinc.
876,000	(7,400 flasks) quicksilver.
350,000	other metals, including antimony, iron, manganese, platinum, tungsten.
280,000,000	(230,750,000 bbl.) petroleum.
19,000,000	(220,000,000 M. cu. ft.) natural gas.
24,000,000	(13,000,000 bbl.) cement.
18,500,000	crushed rock, sand and gravel.
6,500,000	brick and hollow building tile.
464,000	(40,000 tons, crude) magnesite.
1,250,000	other structural materials, including granite, et al.
1,500,000	miscellaneous 'industrial' minerals.
5,000,000	salines, including borates, potash, salt, et al.
$377,205,000	total value.

MUSEUM.

The Museum of the State Division of Mines and Mining possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections in North America; and contains not only specimens of most of the known minerals found in California, but much valuable and interesting material from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Division of Mines and Mining as well as by those who utilize the facilities of the collection.

The exhibit is daily visited by engineers, students, business men and prospectors as well as tourists and mere sightseers. Besides its practical use in the economic development of California's mineral resources, the collection is a most valuable educational asset to the state and to San Francisco.

LABORATORY.

FRANK SANBORN, Mineral Technologist.

Approximately thirty samples per day are received and determined at the laboratory of the Division of Mines and Mining. These determinations are made without cost to the senders. Ordinarily a small sample weighing not over a pound is required in making a determination, but it should be in the unground lump form, if possible. When the precious metals—gold, silver, platinum, etc., are suspected, larger samples should be submitted. The size of the deposit is often of importance in determining the commercial value of a mineral and when possible a statement regarding the extent of the orebody should be made. For instance, a good grade of limestone would probably mean little if the deposit were small, but if the limestone deposit should be extremely large and not far from rail transportation, such a deposit might have commercial possibilities.

The importance of the non-metallic minerals is continually increasing, there now being over fifty minerals of commercial value mined in this state. Therefore, prospectors should have any rock identified that appears to be different than the ordinary country rock.

[illegible]

[illegible] Laws Library

In addition to the [illegible] standard works authoritative information [illegible] law at many [illegible] of the existing and proposed railways is required, [illegible] being issued by the Board of Railway and Railroad Commissioners [illegible] great extension.

The Library of the Division of Mines and Mining contains many [illegible] technical reference on mining, mining and allied subjects, and [illegible] is also a depository for reports and bulletins of the technical depart[illegible] boards of trustees and state governments and of educational institutions [illegible] Louisville and Lexington.

It is not the benefit of the latter publications, but rather a lack [illegible] knowledge of just what has been published and where the reports may [illegible] be examined or obtained, that embarrasses the ordinary person seeking [illegible] specific information.

To assist in making the public acquainted with the valuable sources [illegible] of current technical information, Library is [illegible] publish [illegible] the [illegible] a list of all books and official reports and bulletins [illegible] received, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the [illegible] Library and county and state maps, topographical charts and geological [illegible] folios. Complete copies of [illegible] publications [illegible] to the mineral [illegible] resources of the state are available for reference.

The Library and reading room are open to the public during the [illegible] office hours, when the librarian may be freely called upon for all [illegible] part assistance.

OFFICIAL PUBLICATIONS RECEIVED.

[illegible]

C. H. Cunningham, Governor:

Bulletins:

[illegible]

Professional Papers:

[illegible]

Water Supply Papers:

[illegible]

U. S. Bureau of Mines:

Technical Papers:

323-B—United States Specifications No. 11D. United States Master Specifications for Lubricants and Liquid Fuels and Methods for Sampling and Testing.

419 —Safe practices at Oil Derricks. By H. C. Miller.

407 —Development, Mining and Handling of Ore in Folded and Faulted Areas, Red Iron Ore Mines, Birmingham District, Alabama. By W. R. Crane.

Bulletin 278—Magnetic Concentration of Iron Ores of Alabama. By Oscar Lee, B. W. Candrud and F. D. DeVancy.

Annual Report of the Director to the Secretary of Commerce for Fiscal Year Ended June 30, 1927.

Mineral Resources of the United States:

Lime in 1926.
Natural Gas in 1926.
Clay in 1926.
Arsenic in 1926.
Asphalt and Related Bitumens in 1926.
Salt, Bromine and Calcium Chloride in 1926.
Slate in 1926.
Tin in 1926.
Barytes and Barium Products in 1926.
Antimony in 1926.
Potash in 1926.
Gold, Silver, Copper, Lead and Zinc in the Eastern States in 1926.
Gold, Silver, Copper, Lead and Zinc in Colorado.
Iron Ore, Pig Iron and Steel in 1926.
Gold and Silver in 1925.
Manganese and Manganiferous Ores in 1926.
Asbestos in 1926.
Mercury in 1926.
Feldspar in 1926.
Magnesium and Its Compounds in 1926.
Silica in 1926.
Natural Gas-Gasoline in 1926.
Gypsum in 1926.

Reports of Investigations:

Serial No.

2832—Comparison of Oils Derived from Coal and from Oil Shale. By Joseph W. Horne and Arthur D. Bauer.

2833—Some Methods of Producing Flowing Wells in the Salt Creek Field and Their Effect on Gas-Oil Ratios. By K. B. Nowels.

2834—Reduction of Breathing Losses from Vapor-Tight Lease Tanks. By Ludwig Schmidt.

2835—Coal-Mine Fatalities in September, 1927. By W. W. Adams.

2836—Consumption of Explosives in September, 1927. By W. W. Adams.

2837—The Study of an Intermediate Base Crude Oil. By H. M. Smith.

2838—Safety Measures Save Lives in Colorado Explosion. By E. H. Denny.

2839—Development of Some Fundamentals in the Ferric Sulphate-Sulphuric Acid Process. By Frank S. Wartman and Harmon E. Keyes.

2840—The Carburetion of Combustible Gas with Butane and Propane-Butane Mixtures with Particular Reference to the Carburetion of Water Gas. By Wm. W. Odell.

2841—Coal-Mine Fatalities in October, 1927. By W. W. Adams.

2842—Consumption of Explosives in October, 1927. By W. W. Adams.

Information Circulars:

Circular No.

6049—Railroad Fuel Oil Consumption in 1926. By Arthur Huber Redfield.

6050—Sources and Distribution of Major Petroleum Products Atlantic Coast States—1926. By E. B. Swanson.

6051—Permissible Explosives defined. By Charles E. Munroe.

6052—Mine Safety as Affected by Electrification. By K. L. Marshall.
6053—Regulations and Inspection Prevent Accidents from Falls of Roof. By J. W. Paul.
6054—Practical Underground Education of the Coal Miner. By G. W. Grove.
6055—Some Phases of Accident Prevention in Industry. By Arthur L. Murray.
Secretary of the Interior—Annual Report for the Fiscal Year 1926.
U. S. Coast and Geodetic Survey:
Seismological Report, January, February and March, 1926.
Serial No. 396—Magnetic Declination in California and Nevada in 1927. By W. N. McFarland.
Annual Report of the Director to the Secretary of Commerce for the Fiscal Year Ended June 30, 1927.
U. S. Mint—Report of the Director for the Fiscal Year Ended June 30, 1927.
Library of Congress—Report of the Librarian for the Fiscal Year Ended June 30, 1927.
California Department of Public Works, Division of Engineering and Irrigation:
Bulletin 12—Summary Report on the Water Resources of California and Coordinated Plan for their Development. By Paul Bailey.
Illinois Geological Survey:
The Story of the Geologic Making of Southern Illinois. By Stuart Weller.
Report of Investigations No. 14—Present Status of Correlation of Illinois Coals. By Harold E. Culver.
Kentucky Geological Survey: Molding Sands-Cement Materials. By Chas. Henry Richardson—Geology of the Middlesboro Basin. By Chester Kenneth Wentworth.
Missouri Bureau of Geology and Mines: Water Resources of Missouri, 1857–1926. By H. C. Beckman.
North Carolina Department of Conservation and Development: Economic Paper 60—The Mineral Industry in North Carolina for 1924 and 1925.
Bulletin 35—Fishing in North Carolina.
Oklahoma Geological Survey: Bulletin 43—Oil Sands and Productions Relations. By H. C. George and W. F. Cloud.
Pennsylvania Department of Forests and Waters: Report of.

Societies and Educational Institutions.

Engineering Society of Western Pennsylvania—Proceedings of, Vol. 43, No. 6.
Institution of Mining and Metallurgy: Bulletin 277. Bulletin 278.
National Research Council: Researches in Sedimentation in 1926–1927.
New York Academy of Sciences: Annals of the, Vol. 29—Relativity and the Motion of Mercury. By Chas. Lane Poor.
Vol. 30—Nubbin, a Compound Chromosomal Type in Datura. By Albert Francis Blakesley.
Vol. 30.—The Value of Life History Data in the Study of the Evolution of the Amphibia. By G. K. Noble.
Western Society of Engineers, Journal of, Vol. 32, No. 9.
American Mineralogist, The, Vol. 12, No. 11.
Economic Geology, Vol. 22, No. 7. Vol. 22, No. 8.
U. S. National Museum, Proceedings of the, Vol. 72, Article 21—The Oxidation of Meteoric Irons with Comparative Descriptions of two new Examples of Magnetic Iron Oxides from Terrestrial Sources. By Earl V. Shannon.
Alberta Scientific and Industrial Research Council: Report 18—The Bituminous Sands of Alberta. By K. A. Clark and S. M. Blair.
Seventh Annual Report No. 20, 1926.
Australian Museum, Records of, Vol. 15, No. 6. Vol. 16, No. 1.
Canadian Mining and Metallurgical Bulletin No. 187. No. 188.
Canada Department of Mines:
Investigation of Fuels and Fuel Testing, 1925.
Economic Geology, Series No. 4—Arsenic-Bearing Deposits in Canada. By M. E. Hurst.
Summary Report, 1926, Part A. Part C.
Great Britain Department of Scientific and Industrial Research:
The Country Between Stafford and Market Drayton. By T. H. Whitehead.
The Geology of Belford, Holy Island and the Farne Islands.
Manitoba Industrial Development Board: The Flin Flon Orebody. By R. C. Wallace.

Current Magazines on File.

For the convenience of persons wishing to consult the techni magazines in the reading room, a list of those on file is appended:

Aerican Petroleum Institute, New York.
Architect and Engineer, San Francisco.
Arizona Mining Journal, Phoenix, Arizona.
Asbestos, Philadelphia, Pennsylvania.
Brick and Clay Record, Chicago.
Bulletin, Union Oil Co., Los Angeles.
California Journal of Development, San Francisco.
Cement, Mill and Quarry, Chicago, Illinois.
Chemical-Engineering and Mining Review, Melbourne, Australia.
Engineering and Mining Journal, New York.
Explosives Engineer, Wilmington, Del.
Financial Insurance News, Los Angeles, California.
Graphite, Jersey City.
Journal of Electricity and Western Industry, San Francisco.
Metallurgical and Chemical Engineering, New York.
Mine and Quarry, Chicago.
Mining and Engineering Record, Vancouver, B. C.
Mining and Oil Bulletin, Los Angeles.
Oil Age, Los Angeles.
Oil and Gas Journal, Tulsa, Oklahoma.
Oil and Gas News, Kansas City.
Oil News, Galesburg, Illinois.
Opium, New York.
Oil Paint and Drug Reporter, New York.
Oil Trade Journal, New York.
Oil Weekly, Houston, Texas.
Petroleum Age, New York.
Petroleum Record, Los Angeles.
Petroleum World, Los Angeles.
Queensland Government Mining Journal, Brisbane, Australia.
Rock Products, Chicago, Illinois.
Safety News, Industrial Accident Commission, San Francisco.
Salt Lake Mining Review, Salt Lake City, Utah.
Southwest Builder and Contractor, Los Angeles
Standard Oil Bulletin, San Francisco.
Steel, New York.
Tidal Record, Associated Oil Company, San Francisco.
Through the Ages, Baltimore.

Newspapers.

The following papers are received and kept on file in the library

Amador Dispatch, Jackson, Cal.
Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).
Barstow Printer, Barstow, Cal.
Blythe Herald, Blythe, Cal.
Bridgeport Chronicle-Union, Bridgeport, Mono Co., Cal
Calaveras Prospect, San Andreas, Cal.
California Oil World, Los Angeles, Cal.
Cloverdale Reveille, Cloverdale, Cal.
Colusa Daily Sun, Colusa, Cal.
Daily Commercial News, San Francisco, Cal.
Daily Midway Driller, Taft, Cal.
Del Norte Triplicate, Crescent City, Cal.
Exeter Sun, Exeter, Cal.
Gateway Gazette, Beaumont, Cal.
Goldfield News, Goldfield, Nevada.
Guerneville Times, Guerneville, Cal.
Healdsburg Enterprise, Healdsburg, Cal.
Humboldt Standard, Eureka, Cal.
Inyo Independent, Independence, Cal.

Inyo Register, Bishop, Cal.
Ione Valley Echo, Ione, Cal.
Lake County Bee, Lakeport, Cal.
Mining and Financial Record, Denver, Colo.
Mining Topics, San Francisco, Cal.
Mountain Democrat, Placerville, Cal.
Mountain Messenger, Downieville, Cal.
Nevada Mining Press, Reno, Nevada.
Oatman Mining News, Oatman, Arizona.
Oregon Observer, Grants Pass, Oregon.
Oroville Daily Register, Oroville, Cal.
Petroleum Reporter, Taft, Cal.
Placer Herald, Auburn, Cal.
Plumas Independent, Quincy, Cal.
Plumas National Bulletin, Quincy, Cal.
Randsburg Times, Randsburg, Cal.
San Diego News, San Diego, Cal.
Shasta Courier, Redding, Cal.
Siskiyou News, Yreka, Cal.
Stockton Record, Stockton, Cal.
Tuolumne Prospector, Tuolumne, Cal.
Ventura Daily Post, Ventura, Cal.
Weekly Trinity Journal, Weaverville, Cal.
Western Sentinel, Etna Mills, Cal.



PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

When the publication of MINING IN CALIFORNIA was on a monthly basis, current inquiries from buyers and sellers were summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to the present quarterly publication of MINING IN CALIFORNIA, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes,' and sent to those on the mailing list for MINING IN CALIFORNIA.

EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate attention.

Technical men, or those qualified for supervisory positions, and vacancies of like nature, only are registered, as no attempt will be made to supply common mine and mill labor.

A list of current applications for positions and 'positions open' is carried in each issue. Notices are designated by a key number, and the name and address corresponding to any number will be supplied upon request, without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Division of Mines and Mining, to avoid possible loss. Registration cards for the use of both prospective employers and employees may be obtained upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

POSITIONS WANTED.

61–1 Mill man. Long experience with stamps, amalgamation, concentration, ball and tube mills and some flotation and cyanidation experience. Age 40. Married. References.

61–2 Engineer's helper, mill or laboratory work. One and one-half years' experience. Age 21. Single. References.

61–3 Geologist's or chemist's assistant. Three years' experience. Age 27. Married. References.

PUBLICATIONS OF THE DIVISION OF MINES AND MINING.

During the past forty-eight years, in carrying out the provisions of the organic act creating the former California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the office of the Division of Mines and Mining, in the Ferry Building, San Francisco; New Orpheum Building, Los Angeles; Capitol Extension Building, Sacramento; Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the above offices and enclosing the requisite amount in the case of publications that have a list price. Only coin, stamps or money orders should be sent, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the Division of Mines and Mining.

REPORTS.

Asterisks (**) indicate the publication is out of print.

	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks	----
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks	----
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks	----
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks	----
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DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the state may be sent to the Division of Mines and Mining for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

STATE OF CALIFORNIA

DIVISION OF MINES AND MINING

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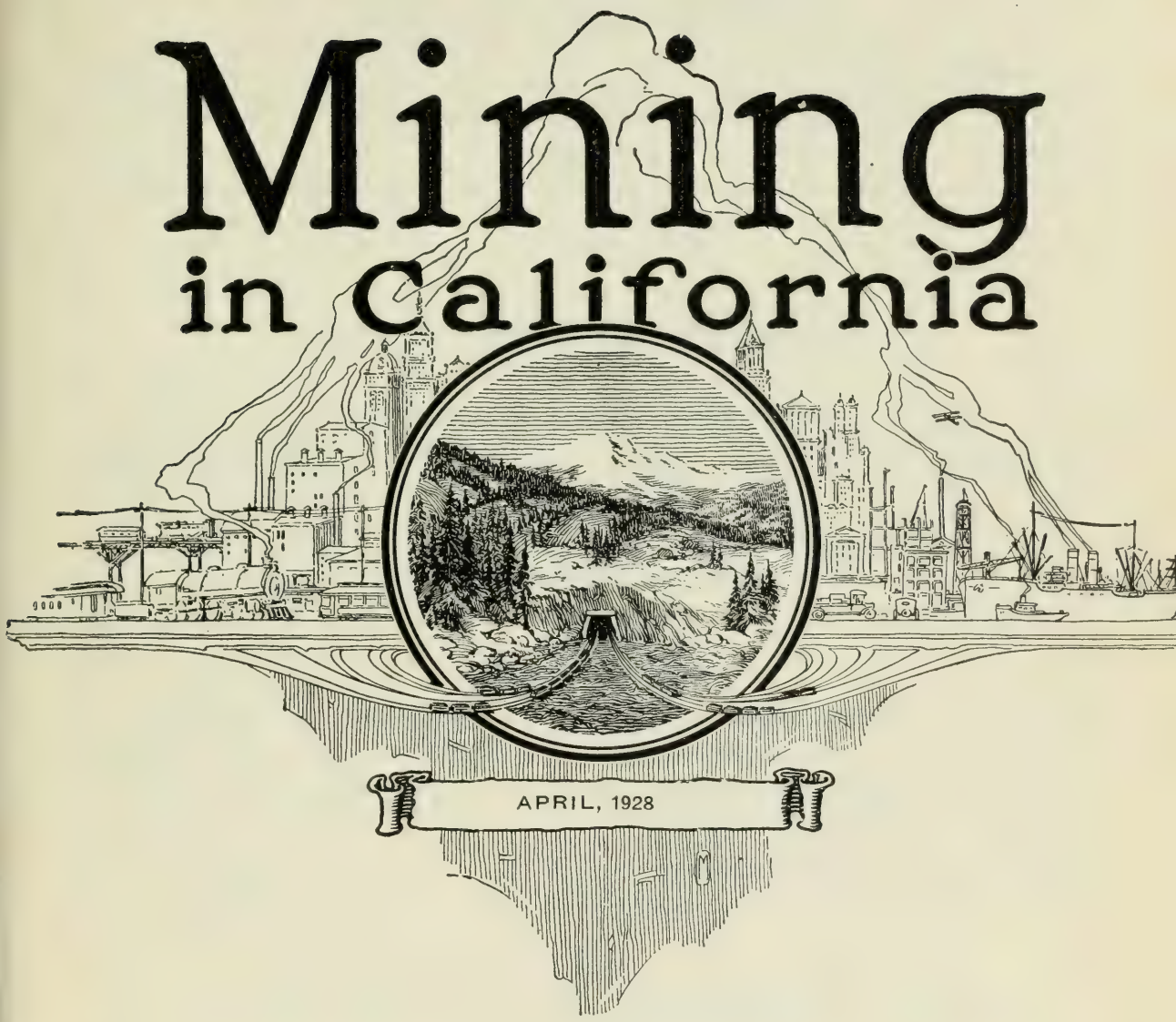
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Note.—A detailed report of the activities of the Department of Petroleum and
is issued monthly by the Division of Mines and Mining, entitled 'Summary of O
tions, California Oil Fields.'

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND MINING
FERRY BUILDING, SAN FRANCISCO

LLOYD L. ROOT — State Mineralogist

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CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1928

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PREFACE

The Division of Mines and Mining (formerly State Mining Bureau) is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing this was changed to quarterly publication, beginning in September, 1923.

For the same reason, beginning with the January, 1924, issue, it has been necessary to charge a subscription price of $1 per calendar year, payable in advance; single copies, 25 cents apiece. 'Mining in California' will continue to be sent without charge to our exchange list, including schools and public libraries, as are also other publications of the Division of Mines and Mining.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the practice of issuing from time to time technical reports on special subjects will be continued, as well. A list of such reports now available is appended hereto, and the names of new bulletins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Division of Mines and Mining is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.

DISTRICT REPORTS OF MINING ENGINEERS

In 1919–1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district, working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively. This move brought the office into closer personal contact with operators, and it has many advantages over former methods of conducting field work. In 1923 the Redding and Auburn field offices were consolidated and moved to Sacramento.

The boundaries of each district were adjusted and the counties now included in each of the three divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

New County Reports.

The series of separate reports on the mines and mineral resources of the different counties, that together comprise the State Mineralogist's Reports XIV to XVII, inclusive, in the case of many of the counties have become exhausted. Those still in stock are in need of revision. It was deemed advisable, therefore, beginning with the January, 1925, issue of 'Mining in California,' to make the district engineers' reports in the form of a complete general report on the mines and mineral resources in one or more of the counties in each district.

This program will be followed as near as possible in succeeding numbers of the quarterly until each county in the state has been covered.

SACRAMENTO FIELD DIVISION

C. A. Logan, Mining Engineer.

On account of unfinished field work there is no report from the Sacramento Field Division in this issue.

LOS ANGELES FIELD DIVISION

W. Burling Tucker, Mining Engineer.

On account of unfinished field work there is no report from the Los Angeles Field Division in this issue.

SAN FRANCISCO FIELD DIVISION

C. McK. Laizure, Mining Engineer.

MARIPOSA COUNTY

Introduction.

This county, whose euphonious name of Spanish derivation indicates its early origin, was one of the twenty-seven counties into which the state was divided at the first session of the legislature in 1850. It shared with San Diego the distinction of being the largest of those counties.

As originally created, it contained the whole of that portion of the state which is now included in the boundaries of Mariposa, Merced, Madera, Fresno, Kings, Tulare, and Kern counties and, in addition, included a large portion of Mono and Inyo and small parts of San Bernardino, Los Angeles, and San Benito counties.[1] Subsequent changes and the creation of other counties have almost without exception tended to diminish its area.

Geography.

Mariposa County is situated in the east-central portion of the state. It is roughly triangular in shape. Its boundary on the southwest, which separates it from Merced County, runs for 35 miles along the eastern border of San Joaquin Valley. The north boundary is an irregular line following the divide between Merced and Tuolumne rivers, trending nearly due east from the edge of the valley to the summit of the Sierra Nevada. Tuolumne County adjoins on the north. From the eastern apex the line separating Mariposa from Madera County runs southwesterly a distance of 65 miles to the edge of the great valley.

As now delineated, Mariposa County has an area of 1463 square miles. Its population is 2775 (1920 census). In 1910 it was 3956, and in 1900 it was 4720, showing a loss of 2000 residents in two decades. Similar losses have been shared by other Mother Lode mining counties during the same period.

Mariposa is the most southerly of the group of five counties through which courses the world-renowned 'Mother Lode' of California; a nearly continuous mineralized vein system that has been actively exploited for more than 75 years, and the locus of a majority of the most productive gold quartz mines in the state.

Mining has always been the chief industry in Mariposa County. At least 80% of its area is mountainous and non-tillable, but a little general farming and stock-raising is carried on in the foothills and there are logging operations near El Portal.

The eastern third of the county is within Yosemite National Park; some of the most noted points of interest in the park, including Yosemite Valley and Mariposa Group of Big Trees, being in this county.

The only railroad in the county is Yosemite Valley Railroad, which connects Merced with El Portal. Much of this line is within the deep canyon of Merced River which it traverses, but it never-the-less provides much-needed shipping points in the central portion of the county.

[1] Coy, Owen C., California County Boundaries, California Historical Survey Commission, Berkeley, 1923.

Yosemite All-Year Highway, which was opened to traffic in 1926, is the only modern improved automobile road. Other county roads leading to the various outlying mining districts, are passable most of the year, but they are little improved and for the most part are narrow, crooked and rough. A large number of mining properties are accessible only by trail.



View taken on road between Mariposa and Coulterville, looking northwesterly along course of Mother Lode, from a point three miles north of Bear Valley, and showing road winding down to bridge over Merced River at Bagby (near center of photo). Drop in elevation approximately 1200 feet.

Electric power lines of the San Joaquin Light and Power Company and the Pacific Gas and Electric Company supply light and power to the principal towns, Hornitos, Coulterville, Bagby and Mariposa. Most of the larger mines on the 'Grant' are also connected up and these lines are gradually being extended to the more remote properties as a demand for service arises.

Topography.

The topography varies from the valley floor in the extreme southwest corner through the rolling foothills in the central portion to the high Sierra at the eastern apex where the elevation ranges around 10,000 feet and over.

The greater part of the county is extremely rugged, being cut by winding streams into many deep canyons with high ridges. Merced River and its branches drain most of the county. Bear Creek, Mariposa Creek and Chowchilla River drain the southwestern portion. The topography is shown in detail on the topographic sheets of the U. S. Geological Survey covering this area.

Geology.

A detailed geological map and descriptive text of the geology of the county and the Mother Lode gold belt from a point near the town of Mt. Bullion north and west beyond the county limits is contained in U. S. Geological Survey Geologic Folio No. 41 (Sonora Quadrangle).

The report of Fairbanks [1] covering a geological reconnaissance in the county is contained in Report X of the State Mineralogist. Further geological notes by Storms [2] are contained in Report XII. Considerable study has been given to the geology of Yosemite Valley and there are fragmentary notes in print covering other small areas, but no single geological report or map, covering the county as a whole, is available. The main features will be outlined briefly here.

The eastern half of the county, the high Sierra and Yosemite Valley region, is composed of granitic rocks. Being within the Park reserve, there is no mining here, although there is reported to be some little-explored mineralized areas containing base ores in the high Sierra. The border of this granite mass curves around to the southwest and with the exception of a long narrow tongue of Jurassic slate, which extends down into Madera County, granite is the predominating formation along the southeastern boundary almost to the valley floor.

In contact with the granite on the west is a broad belt of Calaveras slate (Carboniferous) over ten miles in width trending in a general northwest direction. This belt of slate and schistose rocks contains lenses of limestone and quartzite and is intruded by many porphyritic dikes of igneous rocks. It also contains the many scattered gold quartz veins of the so-called 'east belt.'

West of the Calaveras slate belt, their contact running irregularly northwestward through Mariposa, Bagby and Coulterville, is another belt 10 to 15 miles wide of later Jurassic rocks. This formation includes the Mariposa slate of the Mother Lode and parallel bands of amphibolite schist, porphyrite, serpentine, small limestone lenses and many intruding dikes of igneous rock. Besides the Mother Lode, which in this county is characterized by the great width and prominent outcrop of the quartz veins, there are numerous other gold- and copper-bearing ledges in the western portion of this belt in Hunter Valley, near Hornitos and south toward Raymond, Madera County.

MINERAL RESOURCES

Occurrences of practically all of the metals produced commercially in California have been found in Mariposa County, but gold, silver, and copper ores comprise its chief metal resources. A small output of lead, platinum and chromite is of record and deposits of minor importance or of scientific interest only, containing cinnabar, manganese, arsenopyrite, zinc, cobalt, iron, antimony and other metals have been reported.

Its nonmetallic resources, including structural and industrial minerals, only recently have begun to be utilized to an appreciable extent. Barytes, marble, limestone, jasper, slate and miscellaneous stone have been or are at present being produced. Undeveloped deposits of asbestos, granite, magnesite, feldspar, mica-schist, soapstone, silica and talc also occur, some of which will undoubtedly prove of future value.

[1] Fairbanks, Harold W., Geology of the Mother Lode Region, State Mineralogist's Report X, 1890, pp. 23–90.

[2] Storms, H. W., Geology of a portion of Madera and Mariposa counties, State Mineralogist's Report XII, 1894, pp. 165–166.

MARIPOSA COUNTY, 1880-1926

Year	Gold, value	Silver, value	Copper		Miscellaneous and unapportioned		
			Pounds	Value	Amount	Value	Substance
1880	$150,017	$1,300					
1881	200,000	1,200					
1882	250,000	4,000					
1883	220,000	3,000					
1884	180,000						
1885	149,177	100					
1886	197,600						
1887	187,165	96					
1888	175,000	250					
1889	145,819	210					
1890	124,265	22					
1891	84,414						
1892	81,011	67					
1893	164,116	307					
1894	153,708	39					
1895	216,622	7					
1896	335,637	180					
1897	451,427	660					
1898	336,418	993					
1899	562,829	2,207			110 sq'r's	$600	Slate.
1900	157,663	13,853					
1901	504,928	4,787	191,622	$30,180	70,000 lbs.	3,080	Lead.
1902	631,478	3,880	104,700	11,940			
1903	542,355	3,353	61,627	6,808			
1904	429,771	2,839	11,500	1,466			
1905	386,380	5,231	12,541	1,956		25	Platinum.
1906	366,394	3,377					
1907	405,498	4,500			1,142 lbs.	60	Lead.
1908	439,862	4,732	29,124	2,958		36,560	Miscellaneous stone.
1909	396,465	2,729				62,430	Miscellaneous stone.
						8,431	Unapportioned, 1900-1909.
1910	317,580	2,364				21,501	Miscellaneous stone.
					800 tons	4,800	Barytes.
1911	172,532	1,390	14,641	1,830			
1912	160,541	6,796	284,587	46,957			
1913	171,034	7,430	416,031	64,485		3,130	Other minerals.
						15,366	Miscellaneous stone.
1914	131,458	677	277,472	36,904	2,000 tons	3,000	Barytes.
					100 cu. ft.	100	Marble.
1915	385,577	2,175	38,630	6,760		17,214	Miscellaneous stone.
						600	Other minerals.
1916	401,718	2,680	162,318	39,930	1,857 lbs.	128	Lead.
						4,143	Other minerals.
						39,372	Miscellaneous stone.
1917	313,296	3,221	53,381	14,583	1,075 lbs.	92	Lead.
						13,399	Other minerals.
						7,646	Miscellaneous stone.
1918	337,682	5,083	30,294	7,483		1,856	Chromite and lead.
						400	Miscellaneous stone.
1919	253,392	4,139	24,879	4,627		8	Other minerals.
						400	Miscellaneous stone.
1920	261,830	4,705	[1]			4,096	Barytes, copper, lead.
						400	Miscellaneous stone.
1921	331,295	5,251				5,655	Barytes and pyrites.
						400	Miscellaneous stone.
1922	218,571	3,301				4,960	Barytes, pyrites and miscellaneous stone.
1923	141,883	1,735				27,293	Barytes, pyrites and miscellaneous stone.
1924	182,099	1,608				3,000	Other minerals.
						48,000	Miscellaneous stone.
1925	192,810	1,758				3,500	Other minerals.
						436,794	Miscellaneous stone.
1926	182,313	1,518				130,804	Miscellaneous stone.
						5,089	Barytes, copper and pyrites.
Totals	$12,781,630	$119,750	[1]1,713,347	$278,867		$914,332	

[1]See under 'Unapportioned.'

No record is extant showing the total mineral output of the county. The Hite vein has produced $2,500,000; several of the 'Grant' mines from $2,000,000 to $4,000,000. Add to this the output of the quartz mines in the Coulterville district, that of the mines near Hornitos and in other scattered districts, and the large output of gold from early-day placer operations and the total value must have run high into the millions of dollars prior to 1880.

The table herewith gives the recorded output from 1880, when the compilation of statistics was begun by the State Mining Bureau, to 1926, inclusive. The total for this latter period is $14,094,579. In 1926 Mariposa ranked fortieth among the 58 counties of the state with a mineral output valued at $319,724.

In so far as gold mining is concerned, the conditions in Mariposa County have been peculiar, more than 44,000 acres, covering 15 miles of the 'Mother Lode,' having been held since the first discovery of gold as a single estate known as the Fremont, or Mariposa Grant. It is generally conceded that this situation has thrown obstacles in the way of development and exploitation, for it remains a fact that the 'southern' mines have not been developed to a depth at all comparable with those similarly situated farther north where they have proved prolific at great depths.

The great majority of the quartz mines in the county are only a few hundred feet in depth. The 'boom' days occurred prior to the introduction of the cyanide process for treating low-grade ores, before the adoption of flotation as a means of concentration and long in advance of Diesel and electric power, deep mine pumps, modern air drills and explosives, and other efficient mining equipment. The mines were using wood for fuel, steam for power and crude, often experimental, metallurgical processes. Under such conditions only the richest orebodies could be profitably worked and when these were exhausted operations on a large scale ceased.

Immense reserves of medium and low-grade ores certainly exist and properly financed and well-managed companies should find opportunities here for profitable mining equal to any in the state. The acquisition of a number of properties by new owners, new development work started and the reopening of several idle mines in 1927 indicates that this fact is being recognized and it should result in Mariposa County's mining industry assuming a much more active role.

The writer spent three weeks in the county in October, 1927, gathering data on the mining industry, in order to bring past reports up to date in conformity with the new series of county reports begun in 1925. Owing to long periods of idleness, absentee owners, intermittent working, abandonments, relocations, regroupings, and renaming of mines, it is extremely difficult to give a connected account of operations at many properties. As many as possible were visited and information regarding others obtained from sources regarded as reliable. There are, no doubt, unavoidable omissions, as it would require several months to make a complete check of the county's resources. A list of patented and unpatented claims, showing their nominal ownership (to whom assessed for tax purposes) from the county records, is included so that interested parties can at least get in touch with the owners.

A bibliography follows at the end of the text matter.

Acknowledgments.

Appreciation is here expressed for the courteous treatment and cooperation extended by the mine owners and operators and especially to the various county officials and members of the Mariposa Chamber of Commerce, who offered their assistance freely, and to others with whom the writer came in contact during this survey.

METALS

CHROMITE

Purcell-Griffin Mine. During the world war emergency, shipments of chromite were begun in May, 1918, by Thos. Purcell and Geo. Griffin from a deposit southeast of Coulterville near Pleasant Valley station on Yosemite Valley railroad. This was the first recorded output of chromite from the county and it has been the only producing property to date, although other deposits may be reasonably expected in the serpentine areas.

COPPER

Copper mining began in Mariposa County about 1860, and was carried on with great activity for a decade or more. Some production was also noted between 1900 and 1915. Since then there has been very little activity and most of the old properties, so far as mining is concerned, are deserted, their equipment is gone, the buildings are in ruins and the workings are caved.

The so-called foothill copper belt extends for about 35 miles through the western part of the county from the old Berette and La Victoria mines in Hunter Valley to the Green Mountain Mine, seven miles north of Raymond, Madera County. The surface ores along this belt were high grade, carrying from 20% to 35% copper, besides considerable gold in many instances. Thousands of tons were mined and shipped out, and a crude smelter, believed to have been the first smelter in California, was built a few miles north of the Green Mountain mine and some copper bars produced there.

The deposits have not been explored below a few hundred feet depth, apparently the working of the ores in the leaner zone proving too large an undertaking for small capital, and the district has been so long neglected that it is now a difficult matter to interest large capital.

Among the more important properties are:

Name	*Location* Sec.	*T.*	*R.*	*Owner*
Cavagnero Claim	9	4	16	F. A. Cavagnero, Hornitos.
Cavan-San Jose Copper Group	4, 5	8	18	S. L. Thrift, care Xclusive Laundry, California and Stockton Sts., Stockton.
Great Northern	2, 3, 10, 11	7	17	C. B. Deatsch, Lewis post office.
Green Mountain Mine	3	8	18	A. B. Smith, 625 Call Bldg., San Francisco.
La Victoria Mine	4, 9, 10	4	16	Susan A. Lang, 2637 Shattuck Ave., Berkeley.
Lone Tree Mine	4 and 33	8 and 7	18 and 18	J. W. Westfall, Raymond post office.
Pocahontas Mine	1, 12	7	17	Pocahontas Copper Mining Co., care W. F. Peacock, 58 Sutter St., San Francisco; Newton Webber, Lewis post office.
White Rock Mine	14	7	17	Care J. H. Helm, Lewis post office.

These and other prospects along the copper belt are described in detail in State Mining Bureau Bulletin No. 50, Copper Resources of California, 1908, and this descriptive matter will not be repeated here.

Green Mountain Mine comprises 200 acres covering the top and sides of an unwooded hill in Sec. 3, T. 8 S., R. 18 E., about eight miles north of Raymond. About half the holdings are patented agricultural land and mining claims, and half unpatented mining claims. The property is owned by *California Copper Producers Trust* with headquarters in Boston, Massachusetts. The *Floraferro Company* (not incorporated), A. B. Smith, manager, 625 Call Building, San Francisco, has been operating the mine since 1923.

Country rock is schist which is cut by dikes of diorite and granite. The veins are in the nature of replacements in the schist; are without definite strike and vary greatly in width, in places being 60 feet wide. They dip about 75°. The Green Mountain Mine has been worked extensively at different times since 1863 and has produced large quantities of high-grade oxide and carbonate ores; there being over 4000 feet of underground workings, mainly adits, and many stopes. The sulphide ores are remarkable for being very easily oxidized to copper and iron sulphates on account of their chemical composition. If piled or confined, the ore will heat and this has sometimes resulted in spontaneous ignition, on one occasion a carload of ore in transit to a smelter setting the car afire. As a result, the railroad refused to accept further shipments.

In 1919 the *United Chemicals Company* of San Francisco constructed a leaching and precipitating plant at Raymond. The ore was leached with water in a wooden tank, the solution then run to electrolitic cells and the copper precipitated on scrap iron. The copper was then treated with sulphuric acid and copper sulphate produced. The average ore treated at the plant contained 6% copper.

The *Floraferro Company* took over the property in 1923 since which time they have marketed the oxidized material as a soil corrective and for the control of snails, slugs and insects, under the trade name Floraferro. The ore is prepared by exposing it to the air which causes it to disintegrate into a fine blue-gray powder which is put up in containers without further treatment. Experiments have been carried on recently looking to the development of a market for the unoxidized material as a weed eradicator around power line and telephone line poles and along railroad rights of way. If it proves successful for this use, a greatly enlarged market would result, but it would probably require shipment in metal containers. At present from two to four men are employed.

An analysis of the ore by Smith Emery and Company showed the following composition:

	Per cent
Silica (SiO_2)	7.95
Copper (Cu)	2.04
Antimony, arsenic, etc. (Sb) (As)	Trace
Aluminum (Al_2O_3)	3.30
Ferrous oxide (FeO)	12.86
Ferric oxide (Fe_2O_3)	12.02
Manganese oxide (Mn_3O_4)	Trace
Zinc oxide (ZnO)	Nil
Lime (CaO)	Trace
Magnesia (MgO)	Trace
Soda (NaO)	0.72
Potash (K_2O)	Trace
Sulphuric anhydride (SO_2)	28.12
Sulphur free of sulphides (S)	8.25
Phosphoric acid (P_2O_5)	0.30
Chlorine (Cl)	Nil
Nitrogen in ammonia	Nil
Nitrogen in nitrates	Nil
Moisture and water of crystallization	21.44

A water solution of the sample contained by approximation:

	Per cent
Copper sulphate	5.16
Ferrous sulphate	27.34
Ferric sulphate	20.56
Aluminum sulphate	5.91
Sodium sulphate	1.63
Free sulphuric acid	Small amount

La Victoria Mine. This property was last worked in 1919–1920. W. C. Kroh and C. A. Felts had a working bond and in October, 1919, had 50 tons of ore out and ready to ship to a smelter at Tacoma, Washington. Trucking charge from the mine to Merced Falls was $6 a ton; freight from Merced Falls to Tacoma, $10; and smelting charges, $3.50; a total of $19.50 a ton, so that only high-grade ore could be handled at a profit. Work ceased in 1920 and the mine has been idle since.

GOLD (LODE MINES)

Alarid Prospect. This was a lease on the 'Mariposa Grant' last operated in 1917–18. The prospect was located 2½ miles northwest of Mariposa, presumably on the Mariposa vein. The vein was 2½ feet wide, the strike westerly and dip 60° S. Several hundred dollars worth of ore, which was free-milling and averaged $15 a ton in value, was taken from a shaft 20 feet deep and a drift 100 feet long. Idle for past ten years.

Alice Mine is one of the 'Mariposa Grant' mines, located in Sec. 16, T. 5 S., R. 17 E., about four miles west of Mt. Bullion and close to the Long Mary Mine. There are two claims, which were located in the 50's. The vein is in slate and averages 3 feet in width. The strike is northwest and dip almost vertical. It is developed by a shaft 200 feet deep and 360 feet of drifts on three levels, most of which was done by leasers. The ore averaged $12 a ton. There is no equipment, as it has been idle for more than 20 years.

Artru Mine consists of the Dorothy fractional claim, 450 feet in length located in Sec. 27, T. 4 S., R. 18 E.; owned by Belle McCord Roberts, Long Beach, California. It is in the Colorado district, about seven miles by road north of Mariposa. Elevation, 2700 feet. There is a little timber, but practically no water in summer.

The orebody consists of a soft porphyry dike 20 to 30 feet in width, coursing a little north of west throughout the length of the claim. The walls are slate. The porphyry is seamed with many narrow stringers of quartz carrying free gold; beautiful crystallized specimens often occurring in pockets. Former operations by pick and shovel methods and sluice boxes have resulted in leaving a deep trench the size of the orebody. Other workings consisted of a 75-foot shaft; 450 feet of drifts; four crosscut tunnels, each about 140 feet long, and several raises. The mine has not been worked for about 15 years. The present owner recently purchased the claim from H. Artu, who worked it for many years by crude methods. There is now electric power within three miles.

Austin Group Mine comprises seven claims located in the Whitlock district in Secs. 29, 30 and 32, T. 4 S., R. 18 E., about six miles

northwest of Mariposa; owned by *Mutual Mining Company,* 1723 Webster street, Oakland; last operated in 1912 by the Austin Group Mining and Milling Company. Elevation at the mine, 3300 feet. There is considerable timber and plenty of water in winter for operations. The vein is from 6 inches to 4 feet in width between porphyry walls and carries free gold and sulphides. Development consists of two incline shafts each 120 feet deep, a 700-foot crosscut, 150 feet of drifts and stopes to the surface.

Badger Mine (Prescott). One claim covering an old discovery made in the 50's, from which $80,000 is said to have been taken from surface workings. The claim is situated about five miles northeast of Hornitos in Sec. 2, T. 5 S., R. 16 E. There is a quartz vein, 1½ to 4 feet in width, which is presumed to be the same vein as that in the Mt. Gains mine. Owner, F. A. Cavagnaro, Hornitos. Idle, except for assessment work.

Berette Mine consists of two patented claims, the New Year and the Wild Cat, and 360 acres of agricultural land in Secs. 29, 30, and 32, T. 3 S., R. 16 E., in Hunter Valley, about 15 miles north of Hornitos; owners, Angele Beaudry and Jos. F. Bouvier, 4 Laguna street, San Francisco. The claims were first located about 1868. They are on the so-called 'Blue Lead,' which extends through Hunter Valley in a northwesterly direction for five or six miles; elevation, 1400 feet. A branch of Temperance Creek flows through the property, but water is not plentiful. The vein averages four feet in width, strikes northwest and dips 80° NE. The hanging wall is chert and footwall porphyry. Development consists of a number of old shafts and open cuts from a few feet to 80 feet deep and a short tunnel. No equipment. Idle.

Benton Mill was formerly located on the south bank of Merced River at Bagby, a station on the Yosemite Valley Railroad, at the point where the Mother Lode cuts across the river. The main road following the trend of the Lode between Mariposa and Coulterville also crosses the river here. Before the advent of the railroad, the settlement was known as Benton Mills. There was at one time three quartz mills here and in 1901 the hydro-electric power plant of the Mariposa Commercial and Mining Company, owners of the Mariposa Grant, was built at this place.

In 1920 a single 5-stamp mill known as the Benton mill remained, and the power plant supplying light and power on the 'Grant' was in operation but both have since been destroyed by fire. The Benton mill burned during the winter of 1921; the same fire destroying the highway bridge over the river. The latter was immediately replaced by a new structure.

San Joaquin Light and Power Company now supplies the mines and towns on the 'Grant' with electricity.

Blue Bell Mine (Jumbo) consists of two claims in Sec. 9 T. 4 S., R. 20 E., in rugged country, about four miles by trail east of Jerseydale: elevation, 2400 feet; owner, Hiram W. Bronson, Mariposa. There is a quartz vein, averaging 5 feet in width, which lies between a porphyry footwall and hanging wall of both slate and granite. Its

strike is northwest and dip 72° NE. It is opened up by a 145-ft. crosscut tunnel and drifts on the vein. No equipment except hand tools and blacksmith shop. Idle.

Bobbie Mining Company was organized in 1922 to take over the interests of an association of owners in 120 acres of land in the Moore Hill district, about three miles east of Cathay, known as the *Rich Mine.* There are three parallel veins on the property with diorite walls. The principal vein was reported to contain an ore shoot about 9 feet wide and 200 feet long having an average value of $12 per ton. The ore is a heavy sulphide. The Bobbie Mining Company drove a 1200-ft. tunnel which gave no great depth on the vein and spent the balance of their funds in erecting a mill to treat the ore by a new process worked out by A. E. Vandercook, of Sacramento. In 1923 shortly after completion of the mill operations ceased. The mill has since been removed. Idle.

Bogan and Baitelle Mine (B. B. Mine). This is a patented fractional claim having an area of six acres, located in Sec. 26, T. 4 S., R. 18 E., in the Colorado district, seven miles by road north of Mariposa; owner, R. B. Harper, 8 Porter Building, San Jose. It was a 'pocket' mine, located in 1849 and held by the original locator for over 70 years. Elevation at the property, 2950 feet; topography, rough. There are two veins, one contact vein, 2½ feet wide, between a porphyry footwall and slate hanging wall, and one gash vein. The mine has been developed by four adit levels from 60 to 300 feet long with several raises and stopes. Specimen rock was mined and worked in a mortar operated by a spring pole. There is no equipment. Idle.

Bondurant Mine. This is one of the principal mines in the Coulterville district and one which has been active at intervals during the past decade. The property is about 12 miles northeast of Coulterville on the North Fork of Merced River, and consists of nearly 1000 acres of mineral land located in Secs. 24, 25 and 36, T. 2 S., R. 17 E.; elevation, 3000 feet; topography, fairly steep and rolling. There are 100 acres of patented mineral land, 740 acres of patented timber land, two tunnel locations and one mill site: reported owned by A. L. Adams, 302 Center street, Bridgeport, Connecticut. Taxes on the Bondurant patented claim were assessed to Eva L. Fenn et al., 24 La Salle avenue, Trenton, New Jersey, in 1926–27.

The original claims were located in 1855 and the rich ore milled in an arrastra for several years. In 1870 an 8-stamp mill was built, and in 1887 a new 10-stamp mill was constructed. This ran about five years, then the mine was closed down and remained closed for 23 years. In 1914 five men were working, doing development work, but this work continued for only a year or two. Lack of water, long distance to tram the ore and very hard rock were among the difficulties encountered. In 1926 Walter and Arthur Ritz of Modesto, California, secured an option on the property. They put on equipment, including machine drills, and since July, 1927, have continued development with from two to eight men employed, operating under the name *Bondurant Mining Trust,* address Box 1648, Modesto. Most of this work has been confined to extending the 945-foot crosscut tunnel at the river level.

There are several quartz ledges from 4 to 15 feet in width, all with slate walls. Their general strike is northwest and dip about 35° NE., but steepening to 55° or 60° at 380 feet depth. The three principal veins are known as the Bondurant, Reynolds and Louisiana. The ore is a hard white quartz, carrying gold, silver, lead and zinc, and averaging around $8 a ton. Development consists of a 412-ft. incline shaft, about 1000 feet of drifts, a crosscut tunnel on the river level in 1085 feet and now being extended, another crosscut of 225 feet, a 150-ft. raise and several stopes. The long crosscut tunnel when it taps the vein will give 1000 feet of backs on the dip.

The property is equipped with an old 10-stamp mill gone to ruin; 35-h.p. steam engine, 60-h.p. boiler, and pumps, also a steam hoist and boiler and compressor at the adit portal, mill building, blacksmith shop, bunk house, etc. Work is being continued.

Bouvier Property (Carson) consists of 483 acres of agricultural land and several mineral claims located in Hunter Valley in Secs. 3 and 4, T. 4 S., R. 16 E., about 12 miles north of Hornitos. Temperance Creek runs through the property. There is an old shaft 125 feet deep and several other shallow prospect shafts. The shaft is located on a cross vein about 150 feet west of the main ledge, the so-called 'Blue Lead,' which varies from 2 to 20 feet in width. The cross veins are from 2 to 4 feet wide. There was a 5-stamp mill on the mine when it was operating in 1868, but the mill burned down, and no mining has been done since.

Buena Vista Mine (see Washington-Buena Vista Group).

Bunker Hill Claim (Squirrel Mine). Owned by Harry Taylor, Mariposa. This is an old claim located near Hite Cove on the South Fork of Merced River about six miles southwest of El Portal. It was discovered by quartz brought to the surface from a squirrel hole, hence the original name, Squirrel Mine. There was considerable work done on it in the early days; one of the first quartz mills in the state, with wooden stamps being in operation here in 1851. It was again active for a short time about 1920, but has been idle since.

B. V. D. Mining Company was organized in 1921 to acquire six unpatented mining claims; the Rich-Luckett, Arcturas, Day Break, Moore Hill, Arcturas No. 9 and Arcturas No. 7, located on a new discovery about one-half mile southwest of the Bobbie Mining Company's property near Cathay. The country rock and ore were reported similar to that at the Bobbie Mine, and the same type of mill, using the Vandercook patented process, was erected; but this company also ceased operations in 1923, and the mill has since been removed. Idle.

Carrie Todd Mine. This is a patented claim of 20 acres, located in Secs. 7 and 8, T. 3 S., R. 18 E., in the Kinsley or Bull Creek district, two miles west of Kinsley; owned by Estelle I. Fraser and Geo. Frank, Coulterville. These parties also own the *Fraser and Frank Group* of eight unpatented claims in the same locality. The Carrie Todd was located about 25 years ago. It has been bonded a number of times and has been active at intervals up to the present. The property is near the top of the precipitous east bank of the North Fork at an elevation around 3000 feet.

The vein is from 2 to 4 feet in width between slate walls. It strikes west and dips 75° N. It has been developed by three tunnel levels, each several hundred feet in length, with a winze connecting the middle tunnel with the lower one. There are several mills on the property, including a 3-stamp mill, a 2-stamp mill and a 1-stamp mill. Machinery for a new 10-stamp mill was on the ground in 1920 but not erected. There is also a compressor and two gas engines. (See also, Gentry Gulch Consolidated Mines Co.)

Cardoza Prospect. Cardoza and Fagundes are developing a prospect in T. 5 S., R. 17 E., in the Moore Hill district, on which there is a ledge from 30 inches to 3½ feet wide. They have run a 200-ft. drift on it. The vein carries free gold and sulphides.

Castagnetto Mine. Owned by George K. Allen, 328 Olive avenue, Piedmont, California, who purchased it from the Castagnetto Estate in 1925. The mine is situated in Hunter Valley in Sec. 15, T. 4 S., R. 16 E., about nine miles by road north of Hornitos. Prior to Allen's ownership it was last worked by C. H. Burt under lease in 1916. The vein is between porphyry walls and averages about 18 inches in width. It is developed by an incline shaft 150 feet deep with drifts 100′ and 60′ west on the 70-ft. level. The strike is northwest and dip southwest. Allen has discovered a new prospect on adjoining patented land of the Castagnetto ranch one-half mile from the other workings. The holdings cover one and one-quarter miles along the vein, which is southwest of and parallel to the so-called 'Blue Lead.' A Straub mill is being installed. Water can be obtained from Cotton Creek.

Champion Mine is a patented property of 15 acres, situated two miles north of Coulterville in Sec. 28, T. 2 S., R. 16 E., owned by Mrs. N. C. Ray, Mrs. Mary A. Mentzer et al., Coulterville. It is on the bank of Blacks Creek at an elevation of 1650 feet. A quartz vein, from 6 to 12 feet in width, occurs between slate walls. The strike is N. 17° E. and dip 45° SE. The ore carries free gold, galena, sphalerite and tetrahedrite.

Development consists of an incline shaft 250 feet deep, another shaft 200 feet deep, connected with the first by drifts and several stopes. About 1914 the mine was leased by C. I. Mentzer et al., of Coulterville, who milled several thousand dollars worth of ore in the Potosi mill, which averaged around $45 a ton. A little later it was leased by a Los Angeles company which put on a 10-stamp mill, but operations were short lived and the mine has now been idle for nearly ten years. Both the P. G. & E. and the San Joaquin Light and Power Company's power lines cross the property.

Cleveland Mine. Property comprises the Cleveland, Cleveland Extension and Cannon Gulch placer claims. Owned by Harry Taylor, Mariposa. There is an old shaft 86 feet deep, which caved in 1923, and a 130-foot drift; also several old glory holes on top of a 5-foot ledge. Most of the pay taken out was on the hanging wall. The ledge strikes west and dips 70° N. It lies close to the Buena Vista Mine. Idle.

Colorado Mine consists of the patented Colorado claim and three unpatented claims situated in Sec. 27, T. 4 S., R. 18 E., about seven miles north of Mariposa near the head of Saxon Creek. Owners, Chas. H. Weston, 433 Ninth street; P. W. Jenkins, 1015 Nevin avenue, and Mrs. Emma Dearborn, 328 Second street, all of Richmond, California. The elevation is 3000 feet and the topography fairly rough. The claims are well timbered and sufficient water for milling is available from the creek.

The mine is on the well-known Colorado fissure vein, which can be traced through the Colorado (locally pronounced, Colorow) district for several miles and on which a number of the principal properties in this area are situated. The vein strikes northwest and dips 60° to 80° NE. It varies from 2½ to 7 feet in width, between slate walls.

At the Colorado Mine the vein has been developed by an incline shaft and 500-foot working adit level from the mill, which intersects the shaft at the 125-ft. level. There is another level (drift) 200 feet in length from the shaft, 30 feet above the working adit, and other workings, including several raises and a stope 120 feet long by 35 feet high. The shaft was sunk 100 feet below the adit level, but no development work was done at the bottom. Sampling of the vein where exposed in the workings as shown on a map of the mine indicated values from $4.50 to $27 a ton. About 2500 tons of ore milled when last worked averaged $10 to $11 a ton with some development rock going $8. The ore is a banded quartz and free-milling.

There is a gas engine hoist and Cornish type jack-head pump at the shaft, and 10-stamp mill at the adit entrance. The mill contains a crusher, 10 stamps with Challenge feeders, two 5-ft. by 10-ft plates, two Gates concentrators, tables and two vanners. Two gas engines were used for power. The equipment also includes a 2-drill Rix compressor and several buildings. The mine has not been operated since 1917, at which time it was under lease to Mitchell and Ward.

Consolidated Gold Fields of Mariposa, Inc., was organized in November, 1927, to develop and operate the various mining properties that have been purchased, located or otherwise acquired in Mariposa County during the past year by Belle McCord Roberts of Long Beach. The mines controlled include the Washington-Buena Vista Group, Artru Mine, Spread Eagle Group, King Saxon and Queen Saxon, Sebastopol, Mountain Belle Group, and other holdings, a total of 34 claims together with several tracts of patented mineral land.

The capitalization of the corporation is $3,000,000, and its directors are Belle McCord Roberts, G. A. Smith, M. R. Streeter, R. A. Whitfield and C. Nelson of Long Beach, and W. A. Alderson and M. Mellin of Los Angeles. A little development work was started at one of the mines late in 1927. (See Washington-Buena Vista Group.)

Crown Peak Mine consists of the Crown Peak and mill site patented claims, situated in Secs. 35 and 36, T. 3 S., R. 16 E. It is about two miles northwest of Bagby, near the top of the steep ridge that rises from the east bank of Merced River. The elevation is over 2000 feet. There is no timber or water on the property. Two quartz veins occur on the contact between a serpentine footwall and slate hanging wall. They vary from 6 to 8 feet in width, strike northwest and dip 65° NE.

The owner is George E. Gamble, 1431 Waverley street, Palo Alto, California. The mine has been idle for many years, but in 1927 it was taken under lease and bond by the Gray Eagle Mining Company. This company is extending an adit begun near the river level, which will cut the vein at a depth of 350 feet.

Diana Mines consist of eight claims, Diana No. 1 to No. 8, inclusive, located on the east belt in Secs. 30 and 31, T. 2 S., R. 18 E., owned by *California Gold Mines, Inc.,* care of Mrs. E. M. Coplen, 1535 North Hobart street, Los Angeles; formerly owned by *Diana Mining Company,* of San Francisco. Not active.

Diltz Mine consists of the Diltz and Mann patented lode claims, situated in Sec. 29, T. 4 S., R. 18 E. Owned by Jennie E. Diven, 147 Kempton avenue, Oakland, et al. The same parties also own the Vanderbilt patented claim in Secs. 1, 2, 11 and 12, T. 5 S., R. 19 E., and the Ohio Placer and Johnnie F. claims, adjoining the Diltz and Mann in Sec. 29, T. 4 S., R. 18 E. The Diltz Mine is in the Whitlock district, about six miles northwest of Mariposa. The elevation is 2850 feet, topography rough and well timbered. Water is obtained from springs.

The Diltz and Mann claims were first located in the 60's. There is a quartz vein averaging 20 inches in width, of which 10 inches is ribbon quartz, on the contact between a porphyry footwall and slate hanging wall. It strikes northeast and dips 45° SE.

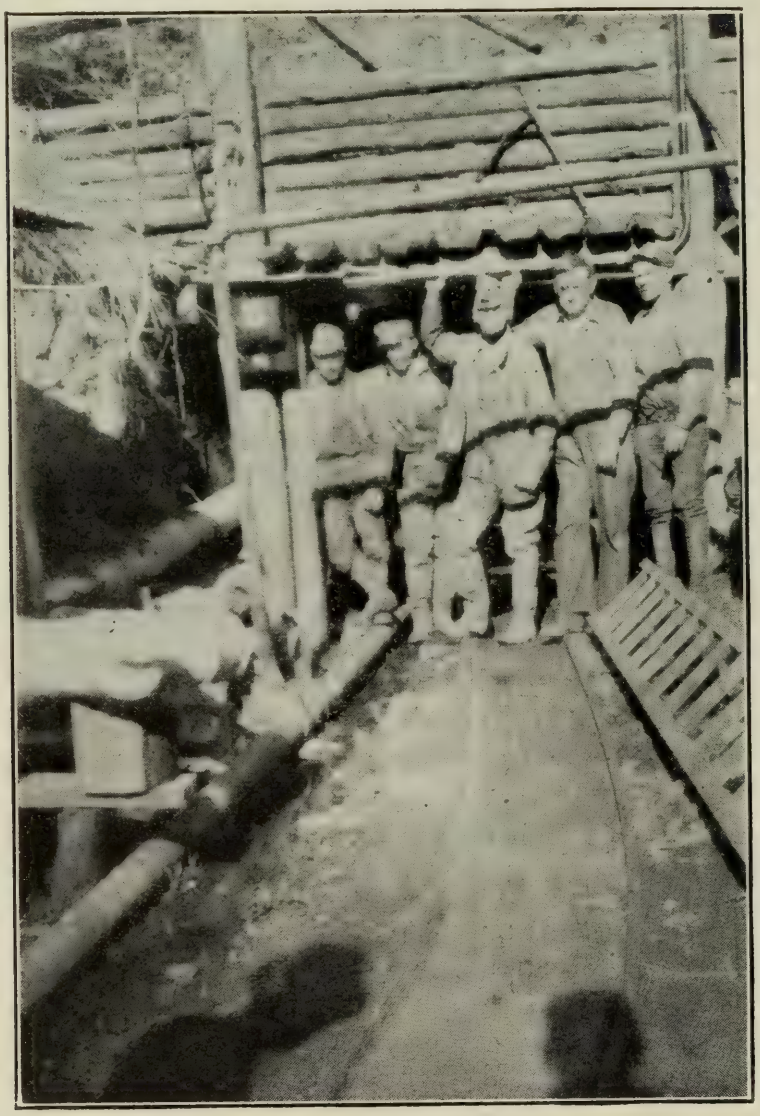
The property was under bond in 1914 to *Mariposa Mines and Development Company,* C. A. Schlageter, T. L. Diven, et al., who did some development and shipped some ore. In 1919–20 two men were working, driving a tunned to cut the ledge. At that time it was in 300 feet. During 1927 the Diltz has been worked by George Ahart of Mariposa, who extended the tunnel to the ledge, then turned and has drifted 200 feet on the vein. Work is being continued by Ahart, and a 10-stamp mill is being installed.

Duncan Mine is a patented property, containing 44 acres, located in Secs. 16 and 21, T. 5 S., R. 16 E., about one mile southeast of Hornitos. It is on the Turner ranch and is owned by George Turner, Hornitos. The deposit is of a pockety character, the veins occurring in porphyry and amphibolite schist. It has been worked intermittently by leasers and has produced some high-grade ore. In March, 1920, a pocket of gold, valued at over $1,000, was uncovered by David Onito and his partner, who were then operating it. In 1926 a company known as the *Duncan Mining Company,* composed of E. S. Hunter, A. H. Allice, D. A. Casad, C. Hausseding, E. G. Casad and Bert Thurber of Oakland, John Rowe of San Francisco, and D. L. Onito of Hornitos, began development and have continued work on a small scale with but few interruptions up to the present. David Onito, Hornitos, is manager.

El Capitan Gold Mining Company. This company, which was incorporated in Nevada April 13, 1925, with capital of $100,000, controls a group of 14 claims situated in Sec. 22, T. 3 S., R. 19 E.; address, care of James H. Eaton, Union League Club, San Francisco. The property is only a short distance above the Original Mine, but on the opposite or south side of Merced River. Some development work was carried on until late in the summer of 1927 on a vein which is supposed to be the same as that worked in the famous Hite Mine nearby.

Eureka Mine comprises a single claim, located on Mt. Buckingham not far from the Mt. Buckingham group, in T. 4 S., R. 19 E. Owners, F. M. Skelton and J. C. Donnelly, Jerseydale. There is a road to within one-half mile and then a good trail to the claim, which lies at an elevation of 3000 feet. Timber is abundant and water is obtained from the mine and springs.

The deposit is a quartz vein, having a width of 18 inches between slate walls. The average value of 12 samples taken from the dump and in the upper tunnel is reported as $26.12, of which over $10 is in free

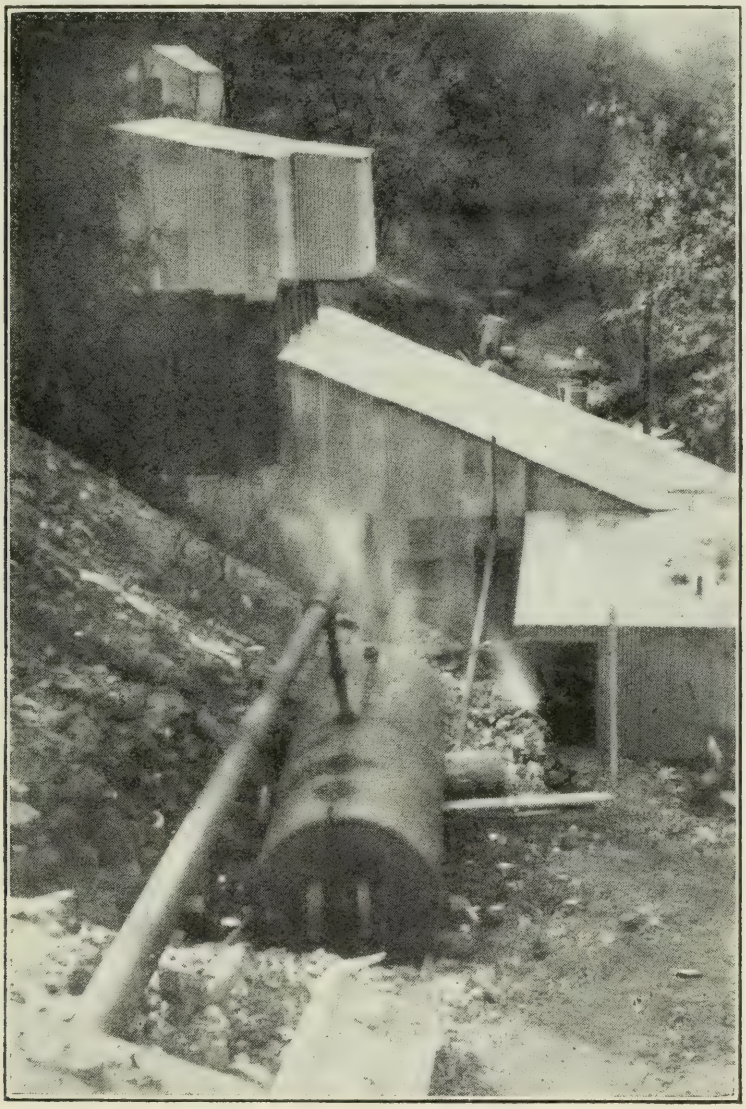


Entrance to main adit level, Feliciana Gold Mine, Mariposa County.

gold. The vein has been developed by two tunnels; the upper one, 360′ in length, gives a depth of 150′; the second, 100′ lower in elevation, is in 415′. There is no equipment, as only assessment work is being done.

Feliciana Mine consists of the patented Feliciana claim and millsite and four unpatented claims, having a total area of 105 acres, situated in Secs. 7 and 17, T. 4 S., R. 19 E., in the Hite Cove district. Owner Feliciana Gold Mining Company, Inc., 462 Phelan Bldg., San Francisco; M. Farber, president; George Zillinger, vice president; Pauline

Farber, secretary; mine address, Box 14, Mariposa. The original Feliciana claim was discovered in the 50's and is said to have had a 10-stamp mill on it in the early days, that was later removed. It had been idle for 30 years prior to 1918, but in 1920 was under lease to J. B. Coyle of Fresno, who worked it at intervals in a small way for a year or two. In 1924 the mine was acquired by M. Farber and associates of San Francisco. Development work was continued and four additional claims were located. The present company was organized in 1925 and the mine has been continuously active since.



45-ton capacity mill at Feliciana Gold Mine, Mariposa County.

The mine is situated at an elevation of 3500 feet in the rugged area near the head of Feliciana Creek, about 2½ miles by trail southwest of Briceburg. It is reached by road in fair condition as far as Jerseydale, but with steep grades, and almost impassable in winter from Jerseydale to the mine. It is within the forest reserve and there is a fair stand of timber on the claims. Water for milling and domestic use is obtained from the mine and springs.

There is one principal fissure vein which has been traced on the surface for several thousand feet. It strikes northwest and dips 75° SW., varying in width from 1½ to 4½ feet. The country rock is a metamorphic schistose or slate-like siliceous rock containing some carbonaceous matter. It shows evidence of considerable movement along the vein. A secondary vein dipping in the opposite direction intersects the main fissure at an angle of about 20° and an ore shoot is developed along the intersecting plane. There are two other small unexplored cross veins coming in on the footwall side.

The mine is developed by a 340-ft. crosscut adit to the vein. On this level there is a drift north 156 feet and south 160 feet. This level is connected with the next lower one by a winze on the vein equipped with a 30-h.p. motor, hoist and skip. The lower level is drifted north 274 feet and south 200 feet. This south drift is being continued to get under an ore shoot showing on the surface south of the present workings.

A power line of the San Joaquin Light and Power Company, 12 miles in length, was completed to the mine in September, 1927, since which time electric power has been used at both mine and mill, the mine workings being electric lighted. There is a 10-h.p. fan for ventilation.

Ore from the main adit is trammed to the mill bin and passes over a grizzley, the oversize going to a 10″ by 12″ Blake crusher discharging to the mill feed bin. From here the ore is fed by a Challenge feeder to a 45-ton capacity Hendy ball mill, using steel balls. The ball mill discharge is conveyed by a bucket elevator to a 40-mesh screen above the ball mill and plus 40-mesh material returns to the circuit, the minus 40-mesh going to two 4′ by 8′ plates and then to a Deiser table. The tailings are impounded and concentrates, which run about $100 a ton, are shipped. Mill heads average $15 to $20 a ton. One 30- and two 10-h.p. motors run the mill. A 12″ by 14″ Rix-Gardner air compressor, operated by a 50-h.p. motor, is housed in the mill building.

Other equipment includes a blacksmith shop with Sullivan drill sharpener and heater, assay office, substantial bunk house, boarding house, with electric refrigeration, office and other buildings. Six to 15 men have been employed during the past year.

Geare Mine (Geary). This is a patented claim of 20 acres, located in Sec. 30, T. 4 S., R. 18 E. in the Whitlock district, about six miles northwest of Mariposa; owned by Jesse S. L. Potter, care of J. S. Potter, 214 American Bank Building, San Francisco; elevation, 2800; topography, fairly rough, with little timber and water only from the mine. There is one vein on the contact between slate and porphyry. It averages 3 feet in width, strikes northwest and dips 80° NE. Old workings include an incline shaft 100 feet deep and 325 feet of drifts. There is no equipment. The mine has been idle for years, though said to be a promising property.

Gentry Gulch Consolidated Mines Company. Thomas Allen Box, president, 225 California street, San Francisco. This company is consolidating under one ownership a number of old properties in the Red Cloud, Bull Creek or Kinsley district. The area in which these mines are situated is steep and rugged, the elevation varying from 1800 to 4000 feet. It is drained by Bull Creek and North Fork of Merced

River. The district lies entirely within a belt of Calaveras slate. Most of the properties were first located in the early days and have been idle for many years. Some of them have made considerable production. A few have been more or less active during the past ten years.

The mines taken over by Gentry Gulch Consolidated Mines Company include the *Scanlon Group* of six claims, located in Sec. 7, T. 3 S., R. 18 E., owner Mrs. Annie A. Scanlon, 601 41st avenue, San Francisco; the old *Hasloe Mine,* comprising two patented claims in Secs. 1 and 2, T. 3 S., R. 17 E., owned by J. S. Morgan and Sons, 614 Third street, San Francisco; the *Bandaretta* (Bandarita) and the *Star.* Other properties which may be included in the consolidation are the *Twin Tunnels,* the *Carrie Todd,* the *Texas Hill, Martin-Walling* and possibly other claims.

Givens Prospect. This prospect is in Sec. 22, T. 6 S., R. 17 E., on the ranch of Geo. R. Givens of Cathay. It was discovered a good many years ago, and, according to reports, a shaft 40 feet deep was put down, the ore being shipped to Selbys. Returns of $100 a ton, mostly in silver, are said to have been received. Considerable water came in at that depth and mining ceased. The hole has since caved and is now nearly filled. The ledge is about 18 inches wide at the surface and can be traced for a mile. Considerable quartz, some highly mineralized with pyrite and silver sulphides, lies around the top of the hole.

Gold King Mining Company, a Nevada corporation, owns the Gold King Group of six claims, situated in Secs. 19 and 32, T. 2 S., R. 18 E.; address, Box 1648, Modesto, California; J. E. Brown, Coulterville, superintendent. Work was carried on at this property during the year 1926 and up to May, 1927, since which time it has been idle. An adit was driven 1445 feet, which it is believed cut through the ledge at about 1385 feet from the portal. Development will be continued in 1928 by coming back 60 feet and exploring the ledge that was apparently passed by.

Golden Gate Group (Schlageter Mine) comprises two claims, situated in Sec. 19, T. 4 S., R. 17 E., about two miles northwest of Bear Valley near the Bear Valley-Hornitos road; owned by C. C. Schlageter of Mariposa. Two quartz veins occur on the property on the contact of slate and mariposite. The veins vary from 3 to 6 feet in width, strike northwest and have a nearly vertical dip. There is a shaft 210 feet deep, an adit level and crosscut to the vein. Intermittent work has been carried on here, including some development during 1927, and there is considerable ore on the dump.

Gray Eagle Mine (Blue Jay) consists of two claims, the Gray Eagle, located in 1894, and the Stella, in 1912. Owned by the *Gray Eagle Mining Company, Inc.;* G. B. Turenetti, president; John D. Turenetti, vice president; Harry Tizor, secretary; H. H. Bever, treasurer; Geo. W. Bever, manager, Coulterville, California. The property is in Sec. 30, T. 3 S., R. 17 E., about four miles by road north of Bagby. Elevation, 1700 feet.

There are two veins between a serpentine footwall and porphyry and slate hanging wall. They strike northwest and dip about 50° NE. The mine is developed by a shaft 133 feet deep and adit level

200 feet long. There is a 155-foot drift on the second level and 300-foot crosscut on the adit level; one stope 60′ by 20′ by 40′ high and one 60′ by 12′ by 35′ high. Equipment includes a 40-h.p. gas-engine hoist and 75-ton Gibson mill. There is no water available except from the mine. The gold was free until the water level was reached, when sulphides appeared, and as a different mill treatment was required, the mine was closed down. The company has recently taken a lease and bond on the Crown Peak Mine, which see.

Hite Gold Mine. This property is situated at Hite Cove on the South Fork of Merced River, in Sec. 27, T. 3 S., R. 19 E. It has a production record of close to $3,000,000 and was one of the most noted mines on the east belt. The Hite, Priest, McConley, Giltner, Old Dominion claims and four millsites, comprising 60 acres are patented. Owner, James S. Spillman, 244 Kearney street, San Francisco. The Arkell Group of eleven additional claims adjoining are assessed to Charles Arkell of Jerseydale, caretaker of the Hite Mine.

The Hite was located about 1863 and the mine was active for 20 years. It was closed down in 1882 and little has been done since. The vein strikes N. 70° W. and dips northeasterly. It is accompanied by numerous branches, mostly into the hanging wall. At one place the vein splits, one branch making into the footwall in a sweeping curve and reuniting with the main fissure about 600 feet from the point of departure, inclosing a lens-shaped mass of slate, 45 to 50 feet thick at the center. The surface croppings of quartz, a few inches to 12 feet in width, were studded with gold and the discoverer, though penniless at the time, soon pounded out enough gold in a hand mortar to carry on development and later build a mill. The vein was extensively developed to a depth of 900 feet but there has been little exploration on the hanging wall side, and as the fissure was still strong at the lowest level worked, further development by diamond drilling, or otherwise, might easily be rewarded by the repetition of the rich ore shoots at lower depths.

Horse Shoe Bend Mining Company is a California corporation, organized January 13, 1922, with a capital of $500,000. The company held an option to purchase 13 unpatented and 1 patented lode mining claims from *Merced River Mines Company,* 319 De Young Building, San Francisco. This group of claims is located in Secs. 15, 16 and 22, T. 3 S., R. 16 E., three miles south of Coulterville and one-half mile from Mast station on the Yosemite Valley Railroad. There are four veins, varying from 1 to 4 feet in width between a slate footwall and serpentine hanging wall. They strike northwest and dip 50° NE. Over 1100 feet of development work has been done. This property was not visited, and nothing was learned regarding any operations that may have been carried on by the Horse Shoe Bend Mining Company. Taxes on the Horse Shoe Group for the year 1926–27 were assessed to Clara Bibbero and David A. Green, care of D. H. Green, 2524 Mission street, San Francisco.

Jenkins Hill Mine comprises the White Oak and one other claim located in Sec. 18, T. 3 S., R. 19 E., adjacent to Yosemite Portland Cement Company's limestone quarry. Owned by W. J. Schofield of

Oakland, and A. B. Smith, 625 Call Bldg., San Francisco. The mine was under option in 1919 and some development work was done. Intermittent work has also been done during the past two years, the last in July, 1927. A lower adit has been driven 90 feet below the old adit, 432 feet. A raise on the vein connects the two. The vein is from 4 inches to 3 feet wide, composed mainly of sugar quartz, and the values are in sulphide minerals, there being practically no free gold. The footwall is granite and hanging wall slate. Electric power is now available and completion of the Yosemite highway has made the property readily accessible. It is expected that work will be started again within a few months. It is said the second mill built in Mariposa County was on this property. It was swept away in the flood of 1862.

Josephine and Eureka Claims are located on a large dike of base ore in the Jerseydale district. Owned by J. C. Donnelly et al. of Jerseydale. There is an old drift, now caved, but no other development.

Josephine Mine. The Josephine proper comprises one claim located in Sec. 16, T. 4 S., R. 17 E. It is one of the noted mines belonging to the Mariposa 'Grant,' and its output was largely instrumental in paying off the debt with which the 'Grant' was originally saddled. It adjoins the Pine Tree and the two are usually operated as a single property. The Josephine is three miles southeast of Bagby. The elevation is 2100 feet, topography rough and sparsely timbered. Water is obtained from Bear Creek.

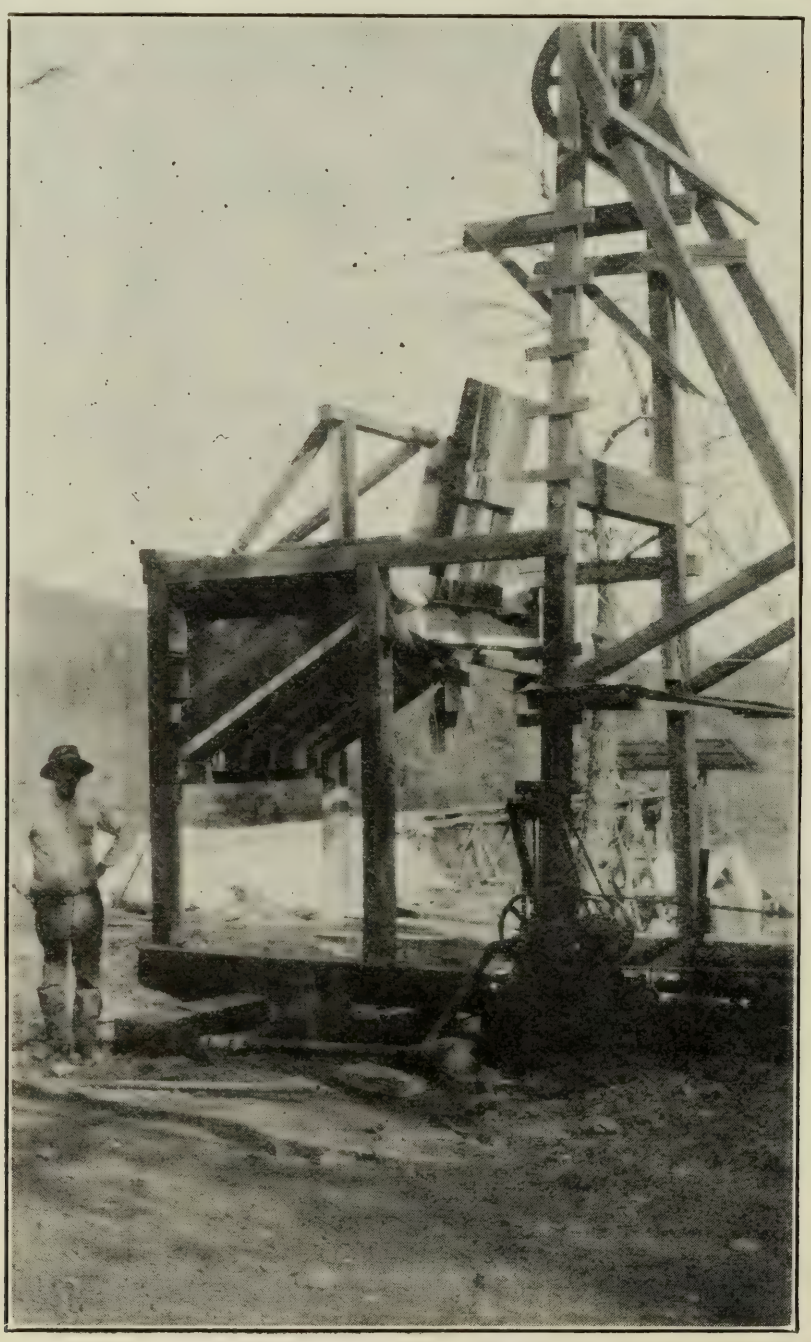
There is one quartz vein, averaging six feet in width, between slate walls. It strikes a little west of north and dips 55° NE. The underground workings are extensive, consisting of a 500-ft. shaft with four levels and several thousand feet of drifts, crosscuts, raises and stopes. One stope is 500 by 200 by 4 feet in size. Subsequent to early operations by the company, it has been worked mainly by lessees. From 1900 to 1915 lessees of the Josephine and Pine Tree produced $371,749 from 29,968 tons of ore. An electric power line crosses the ground. The Josephine is credited with a total production of over $1,000,000.

In 1927 this property and the adjoining Pine Tree were leased to Thos. H. Lipps, 206 Financial Center Building, Los Angeles. Mr. Lipps is president of the Vallecito Mining Company, which is working a rich gravel channel in Calaveras County, and it is presumed that the latter company or a subsidiary controlled by the same interests will shortly start work at the Josephine and Pine Tree.

Jumper Mine. Property consists of two claims covering a discovery originally made in the early 50's. Owner, C. H. Burt, Mt. Bullion, California. This mine is situated in Sec. 30, T. 4 S., R. 16 E., on the nearly level top of Bear Valley Mountain, at an elevation of 3000 feet. It is approximately ten miles to either Hornitos, Mt. Bullion or Bagby, the latter being on Yosemite Valley railroad.

There are two flat parallel veins cut by the present incline working shaft, 180 feet deep, which follows the second or bottom vein. This is a laminated quartz vein, varying from a few inches to 4 feet in width, carrying free gold too fine to be seen with the naked eye. Operation was started by the present owner in 1917, and has been carried on ever since on a small scale, with one to three men employed. The mine is

equipped with a 20-ton Gibson mill. Gasoline engines are used for power. Water for milling purposes is very scarce, but enough rainwater is collected in a reservoir for occasional mill runs. The lowest mill run made recovered $19 a ton. There are four other shafts which have been used at various times in the past. In spite of the fact that



Shaft at King Midas Prospect; mill in right background.
Mt. Bullion, Mariposa County.

this property has been worked off and on since the 50's and almost continuously in a small way since 1917, a stock-raising homestead entry has been filed over it, and the mine owner is compelled to contest it in order to preserve even a water hole for panning tests.

King Midas Mine. This is a new discovery on the 'Mariposa Grant' made in 1925. The King Midas comprises one claim under lease and

bond to J. N. Knight and associates of Mt. Bullion. It is located in Sec. 8, T. 5 S., R. 18 E., one mile east of Mt. Bullion and within 100 feet of the Mariposa-Mt. Bullion road. The deposit occurs along the contact of slate on the west and a serpentine belt on the east. The contact zone, about 100 feet in width, is composed mainly of chlorite schist, which is traversed by six parallel dikes or ledges of talcose rock that carry free gold in seams and along joint planes and fractures, with a small amount of sulphides. The vein dikes are all about 18 inches in width at the surface. They strike northwest and dip 70° NE. A narrow quartz vein, barren at the surface, also occurs on the west near the slate contact. Except for a few surface cuts, development has been confined to only one talc vein. There is one incline shaft 50 feet deep, and 200 feet southeast of this, another vertical shaft 100 feet deep. The latter shaft cuts the vein at 40 feet depth, at which point there is a 6-inch gouge containing finely broken up quartz. A cross-cut run east 40 feet at this level cut a vein 6 feet wide. It is thought that these dikes will unite with the quartz vein at a minimum depth of 300 feet, and that they have robbed the quartz vein of its gold above the junction.

The mine is equipped with a gasoline hoist and Huntington mill with plate, run by gas engine. Talc vein matter taken out in sinking has given an average recovery of $10 to $15 a ton in mill runs. The sulphides which are not saved assayed $190 per ton; mill tailings $4.29, indicating a poor recovery of the values. Some fairly rich rock has been encountered showing free gold plainly visible. Sinking is being continued with two to six men employed.

King Saxon and *Queen Saxon Claims.* These claims, situated in Sec. 21, T. 4 S., R. 18 E., have been acquired recently by Belle McCord Roberts, Long Beach, California. They are about ten miles by road north of Mariposa. The claims were not visited by the writer. It is reported that a quartz vein occurs in a slate belt on which the claims are located. The vein is from 1 to 5 feet in width, strikes north with a flat dip to the west, cutting through the bedding plane of the slate at an angle of 45° to 50°. There is a lower tunnel 450 feet in length, and 80 feet above it another tunnel 300 feet long, both on the vein. Some ore was stoped from the lower tunnel by former owners. A placer claim also has been located alongside the King Saxon, taking in the bed of Saxon Creek, from which water can be obtained. There is a crusher, 6-ft. Huntington mill and gas engine on the property. Samples from the King Saxon are reported by Techow and Davis, Sacramento, to assay as follows:

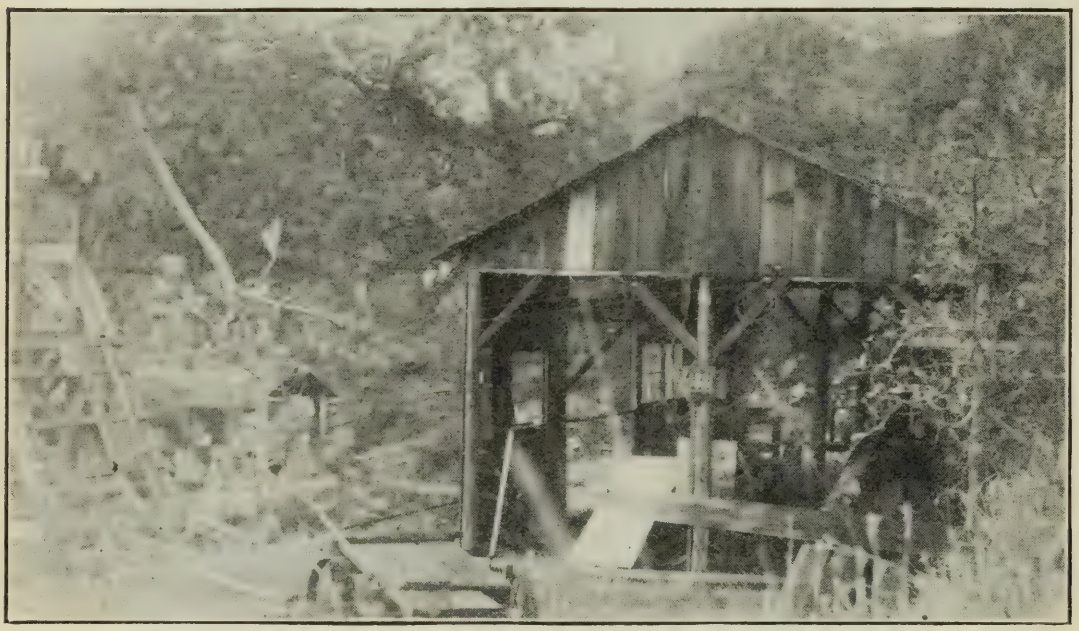
King Saxon: face of upper tunnel	Gold	$3	69 a ton
King Saxon: 4 feet of ore, 60 feet from face	Gold	4	12 a ton
King Saxon: hole in bottom of tunnel	Gold	22	40 a ton
King Saxon: lower tunnel drift	Gold	5	60 a ton
King Saxon: 2 feet of quartz near lower tunnel face	Gold	3	80 a ton

Lafayette Mine (Ghirardella) is an old property on patented agricultural land, owned by Dr. C. A. Queirolo, 892 Isabella street, Oakland. It was worked in 1866–67 and has been idle since. It is situated in Hunter Valley, in Sec. 15, T. 4 S., R. 16 E., about 12 miles north of Hornitos. The country rock is porphyrite, and the vein is on the so-called 'Blue Lead.' A shaft was sunk to water level, a depth of about 150 feet. It is claimed the vein was 2 feet wide at the bottom

and plated $25 a ton, no concentrates being saved. No equipment, and workings caved.

Landrum Mine formerly consisted of three claims in Secs. 34 and 35, T. 4 S., R. 18 E., in the Colorado district, five miles north of Mariposa; owned by Simeon Landrum. The Simeon Landrum claim, in Sec. 34, is now owned by Harry I Maddox, Box 402, Merced; the other two apparently being abandoned. There are three veins, averaging 2 feet in width, between a limestone and talc footwall and porphyry hanging wall. They strike northwest and dip 45° SW. Development is by a 90-ft. shaft and over 800 feet of drifts. No information was obtained regarding any recent operations, and it is probably idle.

Little Wonder Mine. Owned by Little Wonder Mines, Inc., organized in 1920; T. A. Clark, manager, 2961 Webster street, or 412 De Young Building, San Francisco. The company's holdings originally consisted of a group of seven unpatented claims, together with certain mill sites



Hoist and compressor house, at old incline shaft, Live Oak Mine, near Bagby, Mariposa County.

and water rights on the South Fork of Merced River. The claims are in the steep and rugged Devils Gulch section. Considerable money has been expended in building roads and trails to the claims, installing equipment and doing underground development. Ten men were reported working in 1922. Since then intermittent work has been carried on and the holdings, known as the Little Wonder Group, have been increased to a total of forty-six claims, all located in Secs. 6, 7, 8 and 9, T. 4 S., R. 20 E. Work ceased the latter part of 1926, and it is stated that the company is now in process of reorganization, having passed into the hands of a receiver.

Live Oak Mine. (White Oak Group; also Stud Horse Flat Group.) Owner, John P. Carroll, Bagby, California. This property comprises five claims situated in Sec. 35, T. 3 S., R. 16 E., 1½ miles by road from Kittridge station on the Yosemite Valley Railroad, or 3½ miles by trail

from Bagby. There is also a road, in poor condition, to Hunter Valley. The elevation at the mine is 1448 feet, 625 feet above the level of the railroad and Merced River. There is a fair stand of timber on the claims, and water is available from several springs.

The deposit consists of a quartz vein, varying from 3 to 10 feet in width. The strike in general is northwest, with a slight bend in the vein on the center claim of the group. The vein dips 76° W. at the surface, but is apparently getting steeper below the 100-ft. level. Slate and porphyry form the footwall with diorite on the hanging. The quartz carries from $7 to $10 per ton in free gold and high-grade sulphides, the latter assaying from $400 to over $900 per ton. Pan tests show values at the surface the entire length of the claims. There is an 80° incline shaft 140 feet deep, with a drift on the 100-ft. level in which the vein reaches a width of 10 feet. This shaft is caved around the collar. Three hundred feet from the shaft a crosscut adit has been run west 225 feet to the vein. This adit cuts the vein at a depth of about 160 feet, at which point it is 6 feet wide. It has been drifted south about 250 feet, where a winze was put down 20 feet and a raise put up to the surface.

Most of the work has been done by the owner, alone. A 3-stamp mill was destroyed by fire in 1907 after about 300 tons of ore had been milled, since which time there has been no mill. Approximately 400 tons of ore are piled on the dump ready for milling. In 1918 the property was bonded to parties who spent $18,000 during nine months in 1919, but who ran out of funds before any ore was mined. Most of the money was spent on the surface in construction and equipment. A wagon road was built from Hunter Valley to bring in machinery, and two miles of power line built from Kittridge to the mine. A 30-h.p. electric hoist, 10″ by 12″ Sullivan air compressor, 35-h.p. motor and power drills were provided, and a blacksmith shop and other buildings erected. All of the machinery is in excellent condition and remains on the property. It was during this period that the main shaft caved. Since 1919 Carroll has continued development alone and the property is now in such shape that a properly financed company could put it on a producing basis in a very short time and at a reasonable cost.

Long Mary Mine. The Long Mary is another of the well-known 'Mariposa Grant' mines. It is located in Sec. 17, T. 5 S., R. 17 E., about five miles west of Mt. Bullion. Elevation, 1500 feet. Timber is scarce, but water can be obtained from Corbett Creek. There is one quartz vein, 2 feet in width with slate walls. It strikes northwest and dips 60° SW. The mine has produced a total of approximately 10,000 tons of ore, which averaged around $12 a ton in value. Underground workings are quite extensive, consisting of a shaft 413 feet deep, a 263′ adit level, 360′ of drifts on the 200-ft. level, 383 feet on the 300-ft., 315 feet on the 350-ft and 163 feet on the 400-ft. level; also over 900 feet of raises and a stope 400 feet high and 350 feet long. The entire surface equipment, including a complete 5-stamp mill operated by electric power, compressor, blacksmith shop, boarding house and other buildings were destroyed by a forest fire in 1927. The mine was last worked in 1914–15.

Lost and Found Mine. Property comprises eight claims and two mill sites; one of the latter on Merced River. The claims are two miles

northeast of Bear Valley in Secs. 15 and 22, T. 4 S., R. 17 E. Owner, John Naimo, Bear Valley. Timber and water are available for mining. The main vein strikes northwest and dips about 90° NE. Several smaller veins up to 5 feet in width have also been prospected. Development consists of seven shafts, 30′ to 40′ in depth, and four tunnels, 200′, 100′, 65′ and 25′ in length. Assays from $30 to $1100 a ton are reported. Black slate forms the vein walls. Equipment consists of hand tools. Application for patent is being made.

Louis Mine; one of the 'Mariposa Grant' properties, located in Sec. 11, T. 5 S., R. 17 E., about 1½ miles west of Mt. Bullion. Elevation, 2150 feet, topography rough, with no water and no timber. There are two quartz veins, averaging 4 feet in width between slate walls. The ore is free-milling. Development consists of a 400-ft. shaft with two levels; 500 feet of drifts on the upper level and 424 feet on the lower one. There is also a 350-ft adit level, a 115-ft. crosscut, 150 feet of raises and a stope 180 by 80 feet. The Louis was worked intermittently between 1900 and 1912, when it was last active, with a total production during that period of 1240 tons, having an average value of $22.36 a ton.

Louise Mine; one of the holdings of A. S. Bigelow and G. M. Hyans of Boston. (See *Merced Gold Mining Company.*) The Louise is situated on the edge of the town of Coulterville, in Sec. 3, T. 3 S., R. 16 E. The elevation is 1700 feet. Maxwell Creek runs though the property. The quartz vein of the Mother Lode is very massive on this property, it being 20 or more feet in width and outcropping boldly. Development consists of a vertical shaft, 375 feet deep, with three levels. There are 275 feet of drifts on the 100-foot level, 75 feet on the 200-foot level and 500 feet on the 300-foot level, 775 feet of crosscuts, a 150-foot air shaft and 600 feet of winze on the vein. There is no equipment, the ore having been formerly milled at the Potosi mill. It has not been active for many years.

Louisiana Mine consists of one patented claim in Secs. 25 and 26, T. 2 S., R. 17 E., adjoining the Bondurant. Owned by C. P. Treat, 426 Palo Alto avenue, Palo Alto, California. The vein is in slate and varies from 1 to 5 feet in width. It strikes N. 60° W. and dips 45° NE. There is an incline shaft 275 feet deep and a tunnel 150 feet in length. Idle.

Lovely Rogers Mine consists of one patented claim in Sec. 11, T. 3 S., R. 17 E., about nine miles east of Coulterville. Owned by Mrs. Nettie Hanck of Yosemite. The elevation is 2400 feet, topography rough with very little timber or water. There are three veins, varying from 1½ to 2 feet in width. The walls are slate. The mine was developed by a shaft, 100 feet deep; 3 adits, 400, 300, and 250 feet long, and other workings. It was at one time equipped with a mill, but this has been removed. Idle.

Lucky Spot Prospect consists of one claim of 20 acres in Sec. 14, T. 4 S., R. 17 E., in the Sherlock district, six miles east of Bagby. Owner, George Marten, Bagby, California. It is developed by a tunnel 300 feet long, giving 200 feet of backs, and a shaft 40 feet deep. The ore

is said to run from $10 to $30 a ton and there is about 100 tons on the dump. The claim is for sale.

Malvina Mine is another of the properties owned by A. S. Bigelow and G. M. Hyans of Boston. (See *Merced Gold Mining Co.*) The Malvina is in Sec. 4, T. 3 S., R. 16 E., a mile west of Coulterville. It was extensively worked in early days, the ore being hauled through the Potosi tunnel by mules to the Potosi mill. Development consists of a vertical shaft 1000 feet deep, another incline shaft, 875 feet deep; 1275 feet of drifts on the Potosi tunnel level, 400 feet on the 44-ft. level, 387 feet on the 600-level, 225 feet on the 900-level, and 1225 feet of crosscuts. The mine is equipped with a large steam Corliss flat-cable hoist. The ore was low grade, averaging around $4 a ton, and it could not be worked at a profit as equipped. The mine has been idle for many years.

Malone Mine (Bear Creek Gold Mine); a patented property consisting of five claims, located in Sec. 5, T. 5 S., R. 19 E., about seven miles northwest of Mariposa near the head of Bear Creek. The elevation is 2600 feet, topography fairly level and plenty of water for milling purposes. Six separate veins, averaging 1 foot in width but reaching a maximum of 4 feet, occur in granite. They strike north and dip 33° W. Development consists of a shaft 150 feet deep, a 600-ft. crosscut adit level and stope 300 feet long, 90 feet high and 3½ feet wide. The mine is equipped with a 10-stamp mill and steam power plant. It was leased to and was being worked by William Johnson in 1919–20, and had previously been worked to some extent by Thomas Gordon and associates. Idle.

Marble Springs Mine (Compromise). This is an old property said to have had one of the first stamp mills built in the state, consisting of wooden stamps. After being idle for nearly 40 years, it was opened up again about 1920. The property comprises two patented claims, the Compromise and Eubanks, having a total area of 42 acres, and situated in Secs. 30 and 31, T. 2 N., R. 18 E., in the Kinsley district, 14 miles by road east of Coulterville. It is owned by the *Marble Springs Gold Mining Company,* 547 Central avenue, Alameda, California. The mine is in a rugged area; elevation 2800 feet. There is one vein from 2 to 5 feet wide between a slate footwall and diorite hanging wall. It strikes northeast and dips 47° southeast. A good deal of development work has been carried on here during the past several years, and some production has been made from milling ore, but the mill and other equipment was destroyed by fire in 1926, since which time operations have been curtailed. It has been one of the large producers of the east belt. D. G. Kidder, superintendent.

In October, 1926, the mine was reported sold to *California Gold Mines, Inc.,* a Nevada corporation.

Mariposa Commercial and Mining Company. This company is the owner of the famous 'Mariposa Grant' (Fremont Grant), 'Las Mariposas,' an estate containing some 44,500 acres, about 70 square miles, of land shown on the accompanying map. The officers and directors of the company are: Edward H. Benjamin, president; William W. Mein,

vice president; Howard G. Stevenson, secretary-treasurer; Charles W. Slack and Frank T. Maguire. Office, 308 Finance Building, 580 Market street, San Francisco. Andrew Zinkand, manager, Mt. Bullion.

The early history of the 'Grant' is vividly described by J. Ross Brown [1] in his report to the Secretary of the Treasury in 1868. The following brief record up to 1868 is in the main extracted from Brown's report.

The grant was originally made by General Micheltorena to D. Juan B. Alvarado when California was still under the dominion of Mexico. It was purchased in 1847 by Colonel John C. Fremont, who presented his claim to the United States Land Commissioners and the patent was finally issued in February, 1856. The original grant was for ten square leagues of land suitable for grazing in the basin of Mariposa River, but the boundaries were not fixed and Fremont had the right of claiming any land within a large area. He took a long narrow strip of lowland along both sides of the river, the original map of which is in the possession of the Mariposa Commercial and Mining Company.

However, when the final survey was being made, Fremont was informed that the grant must be in compact form, and then, instead of taking grazing land, he swung his lines around and took in the Pine Tree and Josephine mines near Merced River, and other mines that had been in undisputed possession of miners, covering nearly all of the highly mineralized Mother Lode south of Merced River. As a grantee under Mexican law had no right to the minerals, it was claimed that the patent did not give the gold on the grant to Fremont. Disputes, quarrels and litigation began; the mine tunnels were barricaded, and even bloodshed followed. The trouble was finally settled in 1859 by a decision that an American patent for land carries the minerals with it, and Fremont came into complete possession of the land and mines.

A short time afterward the yield of the quartz mines of the estate became very large. The monthly production in 1860 averaged $39,500; in 1861, $53,500; in 1862, the year of the great flood which caused heavy damage, $43,500; and in the first five months of 1863 it averaged $77,000. In May, 1863, it was $101,000, and it was at this time that the estate was sold to an incorporated company formed in New York by Fremont's creditors and capitalized for $10,000,000. The prospectus of the company was alluring and, as the stock was put upon the market at the time of the San Francisco mining stock fever, it was readily sold. The company, instead of canceling the debt and taking stock for it, took a mortgage for $15,000,000, payable in gold, and issued the stock subject to this and other large debts, including $130,000 due to workmen and others in California. Everything was in confusion. The yield for the first five months of 1863, before the sale, was $385,000, with a net profit of $50,000 a month. During the last six months (after the sale) the output was only $186,993, with a net loss of $80,000 a month. In 1864 the yield was $465,000, and the expenditures $760,000. As a result the company soon afterward passed into the hands of a receiver.

[1] Brown, J. Ross, Mineral Resources West of the Rocky Mountains, 1868.

R. W. Raymond,[1] in his report to the Secretary of the Treasury in 1872, says, "Of the celebrated Mariposa Estate and its mines, there is nothing this year to be said. A new set of legal complications has paralyzed operations, but will terminate, it is believed, in a complete reorganization free from encumbrances."

As predicted, in 1873 the Mariposa Land and Mining Company succeeded the old Mariposa Company in the ownership of the estate. Little was done in 1874 and 1875 except intermittent driving of the long tunnel from Merced River designed to tap the Pine Tree and Josephine orebodies. After many vicissitudes during the ensuing ten years the property finally passed into the hands of the sheriff for sale. In July, 1887, the present Mariposa Commercial and Mining Company was organized by Alvinza Hayward, Flood, Hobart, Jones, Mackey, et al., who bought the 'Grant' from one Donahue, who held the sheriff's deed. The new company did practically no mining. Eleven years later, in July, 1898, the present stockholders and directors acquired control and ownership of the property through stock purchased from the original corporation.

Between 1900 and 1915 the total bullion output of the Grant mines was $2,715,839, as shown on the tabulation herewith, most of the mining being done by lessees. There has been but little activity since 1915.

At the end of 1927 the following properties were under lease: Pine Tree and Josephine, Mariposa Mine, King Midas, Rose, Mariposa Extension and Red Bank. These are described under their respective names. The King Midas, Rose, Mariposa Extension and Red Bank are small prospects and were active. The Pine Tree and Josephine and Mariposa mines were only lately taken under lease and bond. Renewed activity at these large properties is expected in the near future.

Mariposa Grant. (See Mariposa Commercial and Mining Co.)

Mariposa Mine. This mine is one of the most important of the 'Grant' properties and was formerly one of the largest producers in the county. It was located in the early 50's and patented in 1857. The Mariposa Mine is situated at the town of Mariposa, in Sec. 23, T. 5 S., R. 18 E. The elevation is 2000 feet, topography rolling and hilly with little timber. Water is obtainable from Mariposa and Stockton creeks.

There are two veins, referred to as the North Fork and West Fork, respectively, which average 5 feet in width. Their general strike is northwest and dip from 60 to 70 degrees SW. The walls are diabase.

Mining was carried on through an incline shaft, 1550 feet deep, with eight levels. Drifts are as follows:

Level	*East*	*West*
275	390 feet	400 feet
475	400 feet	637 feet
625	700 feet	600 feet
800	322 feet	410 feet
970	396 feet	412 feet
1200	250 feet	400 feet
1400	60 feet	50 feet
1550	200 feet	130 feet

All ore has been stoped out from the 800-ft. level to the surface. Many of the underground workings are caved. The mine has not been worked since 1915 and a great deal of the equipment has been removed. A

[1] Raymond, R. W., Mineral Resources West of the Rocky Mountains, 1872.

large mill was destroyed by fire years ago. A 5-stamp mill remains on the property.

From 1900 to 1915 a total of 112,378 tons of ore were milled, having a bullion value of $693,205, or an average value of $6.17 a ton. Total operating costs when last operated in 1915 are reported to have been approximately $4 a ton. Electric power was used. There was also a very large production from the mine during its early period of activity.

In 1927 the California State Highway Commission crushed the large dump at the Mariposa Mine, producing 35,000 tons of crushed rock, which is to be used for highway construction. The material is in a storage pile adjacent to the Yosemite Valley highway, one-quarter mile south of town.

Richard Jeffrey, of Briceburg, was negotiating for a lease on the Mariposa Mine in 1927, but it had not been obtained at the time of visit.

Mariposa Extension Prospect (Rovnianik). P. V. Rovnianik of Mariposa has a lease on this mine, which is one of the 'Grant' properties situated on the west side of Mariposa Creek near the town of Mariposa. He has been doing intermittent development work on this prospect and has uncovered some fairly good ore. At present additional equipment is being installed.

Mary Harrison Mine: the deepest of the four large mines owned by A. S. Bigelow and G. M. Hyans of Boston. (See *Merced Gold Mining Company.*) The Mary Harrison is in Secs. 10 and 11, T. 3 S., R. 16 E., one mile south of Coulterville. The elevation is 1900 feet, and topography rough. Water is obtainable from Maxwell and Black creeks. There are two quartz veins on the Mary Harrison, averaging about 7 feet in width, between slate walls. They strike northwest and dip 50° NE. Developments consist of a vertical shaft 1200 feet deep, with 12 levels, approximately 5000 feet of drifts; also an incline shaft 800 feet deep and many raises, crosscuts and stopes. When operated, the ore was hauled over a narrow-gauge railroad by a steam locomotive to the Potosi mill for treatment. It is said to have averaged $7 to $12 a ton in value. The mine was equipped with four 60-h.p. steam boilers, large steam hoist, with flat cable, compressor and other machinery, all of which were burned in August, 1926. It has been idle for 25 years or more.

Merced Gold Mining Company. Thirty years ago this was one of the largest operating companies in the county. It is now dissolved, and their former holdings are owned by Messrs. A. S. Bigelow and G. M. Hyans of Boston, Massachusetts. C. L. Mentzer, Coulterville, is local agent. These holdings comprise 26 patented claims, 7 mill sites, two 160-acre homesteads and one 160-acre timber-tract, nine miles above Coulterville. The total area is 1000 acres. The mineral land is in Secs. 3, 4, 10 and 11, T. 3 S., R. 16 E., and Secs. 32, 33, and 34, T. 2 S., R. 16 E., in the Coulterville district, near the town. The more important productive mines of this estate were the Mary Harrison, Louise, Malvina and Potosi. The ore was treated in a 40-stamp mill at the Potosi Mine, and was hauled from the other mines by a steam locomotive and train of ore-cars over 3½ miles of narrow-gauge track. When last operated, steam power was used with wood for fuel. An electric power line now crosses the property. Some of the equipment at the various

mines remains in place, but the Potosi mill and machine shop were destroyed by fire in 1926. Surface equipment at the Mary Harrison was also burned. The deepest shaft is on the Mary Harrison, 1200 feet. Large reserves of comparatively low-grade ore are said to remain in the various mines.

Mexican Mine (El Carmen) is an old property located in Sec. 36, T. 3 S., R. 19 E., in the Hite Cove district, six miles north of Jerseydale; owned by Frank H. Catherwood, Jerseydale. The elevation is 3500 to 4000 feet, topography rugged. There is not much timber and water is scarce at the mine except in winter. Two quartz veins, from 2 to 6 feet in width, with slate walls striking northwest and dipping about 80°, have been developed by an incline shaft 150 feet deep and a total of 625 feet of drifts. The ore is 'ribbon rock' and carries free gold. The property has been idle in recent years and there is no equipment on it.

Mocking Bird Mine consists of one claim, patented in 1904 and owned by J. A. and C. J. Schroeder of Mariposa. The Mocking Bird Mine is on an extension of the Colorado vein, and is situated in Sec. 27, T. 4 S., R. 18 E., in the Colorado district, about six miles north of Mariposa by road. Elevation, 2700 feet; plenty of timber and sufficient water for milling from springs. The vein averages 3 feet in width and is on a contact between a porphyry footwall and slate hanging wall. It strikes northwest and stands nearly vertical. The ore is free-milling. The vein is intersected by a talcose-porphyry dike, which appears to have robbed the quartz vein of values. There is a 100-ft. shaft with drifts and a tunnel 500 feet long. The mine was last worked under lease by Weston Brothers, who took out considerable ore; not active recently.

Mountain Belle Group. This property includes three mining claims: the Dorothy (Artru Mine, which see), White Oak and Blue Quartz, together with 160 acres of patented land containing several veins (Hayes property) and mining rights on 80 acres of patented land (McMillan property; also called Champion Mine) now grouped under the name Mountain Belle, and owned by Belle McCord Roberts, Long Beach, California. These holdings are situated in the Colorado district, about seven miles north of Mariposa in T. 4 S., R. 18 E. Elevation from 2500 to 3000 feet. There is ample timber, but water is rather scarce except in winter. The following notes regarding the holdings are excerpts from a report made for the owner by Walter Techow, Sacramento:

"A strong vein passes through the whole length of the White Oak and Blue Quartz claims and has been opened up at several places on the surface. It has a general north-south course and width of two to three feet. An old shaft on the vein is now caved. Two samples from the dump, the first clean iron-stained quartz and the second an average of the whole dump and containing surface dirt, assayed $46.40 and $7.20 in gold, respectively. Both walls are diorite. Another vein, locally called the Champion, passes through the patented land and can be traced for 4000 to 5000 feet. Its course is east-west and it probably intersects the White Oak vein. The Champion vein is from eight to twelve feet wide and has been opened up by a shaft, now caved, near the center of the group. The size of the dump indicates a great deal of work was done through it. Several arrastras were at work here in former days. An average sample of the dump assayed $7.50 a ton. The Champion vein occurs in slate and its eastern end is crossed by a soft porphyritic dike similar to the highly productive one on the Artru claim. This dike has been placered to some extent, but it is evident that only a little water was available for placer operations. The Champion vein is very persistent and uniform. The slate belt in which it occurs is narrow and in places the vein appears to be in contact between slate and granite. Electric power is only a few miles distant."

Mountain Belle Mine; one patented claim in Sec. 25, T. 5 S., R. 17 E., six miles west of Mariposa in the Guadalupe district. There is one vein, 3 feet in width. The strike is northwest and both ends of the vein run onto the Mariposa Grant property; dip, 30° SW. There is an incline shaft 174 feet deep, with two levels and about 100 feet of drifts. There was a 5-stamp mill on the mine and the ore is said to have run $21 a ton. Idle since 1908. Last known owner, J. D. Crichton, San Francisco.

Mountain King Mine. This has been one of the more important producing properties situated outside the 'Grant.' It was active almost continuously for 20 years, closing down in 1922. It is owned by the Mountain King Mining Company, 314 Kohl Building, San Francisco; at present in course of dissolution. The property consists of a group of 18 patented claims having an area of 348 acres, located at Mountain King in Sec. 31, T. 3 S., R. 18 E., and Sec. 6, T. 4 S., R. 18 E., on the Yosemite Valley Railroad and Merced River, six miles east of Bagby.

There are four veins which average 5 feet in width between slate walls. Their strike in northwest and dip 65° NE. The mine was developed to a depth of 2200 feet, there being a total of four or five miles of underground workings. For the most part the ore was low-grade, running from $4.50 to $5 a ton.

The property was equipped with a complete 30-stamp mill, sawmill, hoist, and compressor, all operated electrically, and an electric locomotive for hauling ore from the mine to the mill. The company also owned their own hydro-electric power plant situated on the river about one mile below the mine, which supplied all power used.

When operations ceased in 1922, due mainly to increasing costs with deep development bringing profits to the vanishing point, the power plant was sold to the San Joaquin Light and Power Company and all other equipment sold and removed except a cottage or two for accommodation of the watchman.

Mountain View Mine, another of the 'Mariposa Grant' properties, is located near the Louis Mine in Sec. 11, T. 5 S., R. 17 E., about two miles northwest of Mt. Bullion. The elevation is 2155 feet; surface rough with no timber and very little water available. There is one vein, averaging 2½ feet thick with slate walls. Strike northwest and dip about 60° NE. There are two adit levels with over 1000 feet of drifts and crosscuts, also a number of raises and stopes. From 1910 to 1920 the mine was worked quite regularly by lessees, the ore being milled in the Princeton mill. The ore taken out was fairly high-grade, averaging from $40 to $50 a ton with some lots as high as $90. It has not been worked recently, and is now standing idle.

Mount Buckingham Group consists of eight quartz claims and 169 acres of patented timber land, a total of 339 acres. The claims were first located in 1850 by Wm. Buckingham. The property is now owned by Jas. L. Diven, 147 Kempton avenue, Oakland. It is situated in Secs. 1, 2, 11 and 12, T. 5 S., R. 19 E., about ten miles a little north of east from Mariposa. The topography is very rugged, the elevation being 4600 feet. Good timber and water are available.

There are five veins, called the Vanderbilt, Golden Slipper, Crown Point, Apex and Sunnyside. Their general strike is northwest and they dip southwest from 70° to 85°. Widths vary from 10 to 12 feet. This is considered to be a large low-grade property, the veins being reported to assay from $4 to $15, and there has been considerable development, including a 500-ft. crosscut tunnel, a 250-ft. raise and a number of winzes and stopes. There was a 10-stamp mill on it in early days, but this was destroyed by fire years ago. In 1927 some work was done, about 200 feet of drift being run on one of the veins, but as the ore developed only ran $3 a ton and did not pay, the work was stopped. Idle.

Mount Ophir Mine. This is another Mother Lode mine on the 'Mariposa Grant,' owned by the Mariposa Commercial and Mining Company. It is located in Sec. 12, T. 5 S., R. 17 E., about one mile northwest of the town of Mt. Bullion. The elevation is 1900 feet, the surface rough with no timber and very little water. There is one vein, averaging 5 feet in width between a serpentine footwall and slate hanging wall. It strikes northwest and dips 55° NE.

The development work consists of three adit levels with a total of 1500 feet of drifts, 360 feet of raises, an 80-ft. crosscut, 20-ft. winze and stope 5 feet wide, 200 feet long and 300 feet high. There is no reduction equipment. A power line crosses the property.

This mine was opened in the early 50's and the ruins of what is said to be the first mint in California may still be seen here. Fifty-dollar gold slugs were minted. The mine was closed by the company in 1900. Between 1900 and 1913, inclusive, various lessees took out approximately 2400 tons of ore which averaged $12.37 a ton. Idle since 1914.

Mt. Gains Mine. This is one of the larger mining properties in the Hornitos district. From a distance it has a prosperous appearance with its 20-stamp mill and numerous buildings, blacksmith shop, store house, office, cookhouse, two bunk houses, assay office, eleven cottages and cabins, all painted red, large gallows frame and mine dumps, but it has been idle since 1910. The Mt. Gains property includes a group of 15 claims, 200 acres of patented land and 160 acres of mineral rights. It is in Sec. 35, T. 4 S., R. 16 E., seven miles northeast of Hornitos, or 14 miles from Merced Falls on the Yosemite Valley Railroad; address, Mt. Gains Mining and Milling Company, care of Glenn C. Williams, Route 1, Box 291, Bellflower, California. The surface consists of low rolling hills, the elevation at the mine being only 1100 feet. There is no timber. Water can be obtained from the mine and springs.

There are extensive underground workings, consisting of a shaft, 1350 feet deep, with 11 levels; a total of 7840 feet of drifts and several stopes, 5 feet wide and from 400 to 500 feet high. The vein is from 4 to 30 feet in width between a granite footwall and schist hanging wall. Its strike is northeast and dip 30° SE. The ore occurs in kidneys and lenticular bodies.

The mill had a capacity of 85 to 100 tons a day, and the average value of the ore milled is reported to have been around $8 a ton, the concentrates running $150 a ton. Electric power was brought in from Merced Falls. The shaft is down a considerable distance below the

lowest level worked and it is claimed the vein showed up strongly all the way. The operating company got into debt in 1910, the mine was closed down and later sold at sheriff's sale. It was unwatered in 1917, but no production was made. Idle, and reported still in litigation.

North Star and *Oro Grande Claims.* These claims are situated in Sec. 32, T. 4 S., R. 18 E., in the Whitlock district. They are about one mile south of the Spread Eagle Group, and four miles by road north of Mariposa. Owner, Belle McCord Roberts, Long Beach, California. The claims are traversed by a quartz vein, which strikes north and dips easterly at a flat angle. The walls are porphyry. Former owners opened up the vein to a shallow depth by a crosscut tunnel 150 feet in length. It is narrow where cut, but shows up 3 to 4 feet wide on the surface at other points. There has been no development except one stope near the crosscut and a few shallow surface cuts. These claims adjoin the old Whitlock Mine which was worked to a depth of about 1000 feet, and the North Star-Oro Grande vein intersects the Whitlock vein at a depth of 800 feet on the Whitlock property, where much good ore was reported taken out. Electric power is now available within a short distance. Samples taken by Walter Techow of Sacramento are reported to assay as follows:

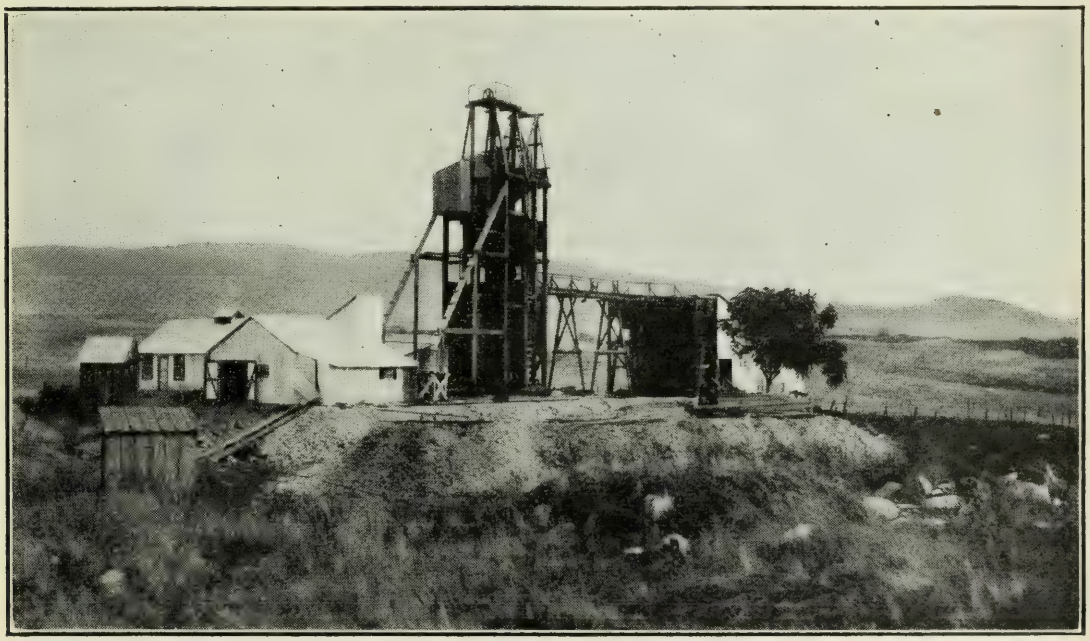
North Star-Oro Grande:

6 inches of quartz at tunnel	Gold	$50 40 a ton
10 inches both faces of stope, average	Gold	29 60 a ton
3 feet of vein on surface	Gold	4 80 a ton
Vein south of crosscut on surface	Gold	4 12 a ton

Number Five Mine comprises two full claims and two fractional claims, having a total area of 60 acres. Owner, Number Five Mining Company; J. J. Le Tourneau, secretary-treasurer, 2643 Hillegass avenue, Berkeley, California. The property is in Sec. 10, T. 5 S., R. 16 E., about five miles northeast of Hornitos. The surface is composed of low rolling hills, barren of timber. Elevation, 1400 feet. Water is obtained from springs. There are two quartz veins which have a diorite footwall and schist hanging wall. The strike is northeast and dip 45° NW. Opened up by a shaft 260 feet deep with three levels and 110 feet of drifts. The mine is equipped with a ball mill and amalgamation plates, electric hoist, compressor, machine drill, boarding house, assay office and several other small buildings. Electricity was furnished by the San Joaquin Light and Power Company. The Number Five Mining Company acquired the property in 1914 and worked it for some time. It was active at intervals until 1922. Idle at present.

Number Nine Mine. This property comprises 403 acres of patented land in Sec. 10, T. 5 S., R. 16 E., located about three miles northeast of Hornitos. Owner, Number Nine Gold Mining Company; L. A. Ginaca, president; home office, 1237 Twenty-third avenue, Oakland; B. S. McArthur, mine superintendent. The mine was formerly owned by the Mose Rogers Estate of San Francisco, and the property was in litigation for a number of years prior to 1924, at which time the lawsuits were finally settled. Since then the company has been carrying on development work, consisting mainly of cleaning out and retimbering all workings and shafts. There are four shafts, the Keys vertical shaft, 140′ deep, and three incline shafts, No. 9 shaft, No. 5

shaft and Josie shaft; the deepest, No. 5, being 600′ on the incline. Sinking, drifting and crosscutting is being carried on at this shaft. Twelve veins in all have been encountered. These exhibit considerable variation in both strike and dip, there being apparently two series of veins, one of very flat dip, 20° to 28°, and another series of nearly vertical cross veins, showing the area to have been one of great disturbance. Diorite occurs on the footwall and thinly laminated schist or slate and porphyry on the hanging wall. The general trend of most of the veins is northwest and all of the flat series of veins dip east. One lode or vein in No. 9 shaft is said to be 40 feet wide and mineralized the full width. The other veins are comparatively narrow. The ore is a heavy sulphide, the principal value being in gold. A recent shipment of selected ore was made to Selby smelter.



Key shaft and mill at Number Nine Gold Mine, near Hornitos, Mariposa County.

The mill contains two 10-stamp Straub mills and two concentrators, a Wilfley and a Deister. There is a 2-cylinder Union gas engine hoist, two 6″ by 7″ I.-R. compressors, shop, boarding house, assay office, dwellings and office building. The company proposes to install electric power in the near future. Eight men are employed underground.

Number One Mine comprises one full claim, first located about 1875. It is situated in Secs. 34 and 35, T. 4 S., R. 16 E., about five miles northeast of Hornitos. Owner, *Treasure Gold Mining Company,* address uncertain. There is one quartz vein about three feet in width with a slate footwall and diabase and porphyry hanging wall. It strikes northwest and dips 43° southwest. Development consists of a shaft 360 feet deep with three levels, about 1200 feet of drifts and several large stopes. The mine was equipped with a 10-stamp mill operated by electric power, electric hoist, assay office, bunk house and other buildings. It was last operated in 1914–15. Since then the mill has burned down. Idle.

Oaks and Reese Mine. This mine was famous in the early mining history of Mariposa County, as it was at one time a very large producer. From 1868 to 1870 it is credited with a production of $30,000 a month. A lawsuit over water rights and the reaching of the limits of a rich shoot they had been working caused the shut-down many years ago. The Oaks and Reese is located in Hunter Valley in Sec. 32, T. 3 S., R. 16 E., about 14 miles north of Hornitos. It consists of two patented claims, the Grand Prise and Badger, owned by Oaks and Reese Mining Company, controlled by New York people.

There is an incline shaft 450 feet deep and about 800 feet of drifts. The shaft is located at the junction of the main or 'blue lead' with a cross vein known as the 'Potts.' The main vein is about four feet wide and the latter 18 inches. About 400 feet south of the shaft another vein, the 'Floyd,' joins the main vein. The 'Floyd' is 15 inches in width. The main vein strikes northwest and dips about 80° northeast. Chert forms the hanging wall and porphyrite the footwall. Most of the work was done on the 'Potts' vein, there being very little development on the main vein. Both the 'Potts' and 'Floyd' veins are said to be rich and it is claimed the run of mine ore will average around $10 a ton. The old 28-stamp mill used in early days has long since been removed. A hoist and gallows frame remains on the ground. The shaft has been retimbered since the shut-down.

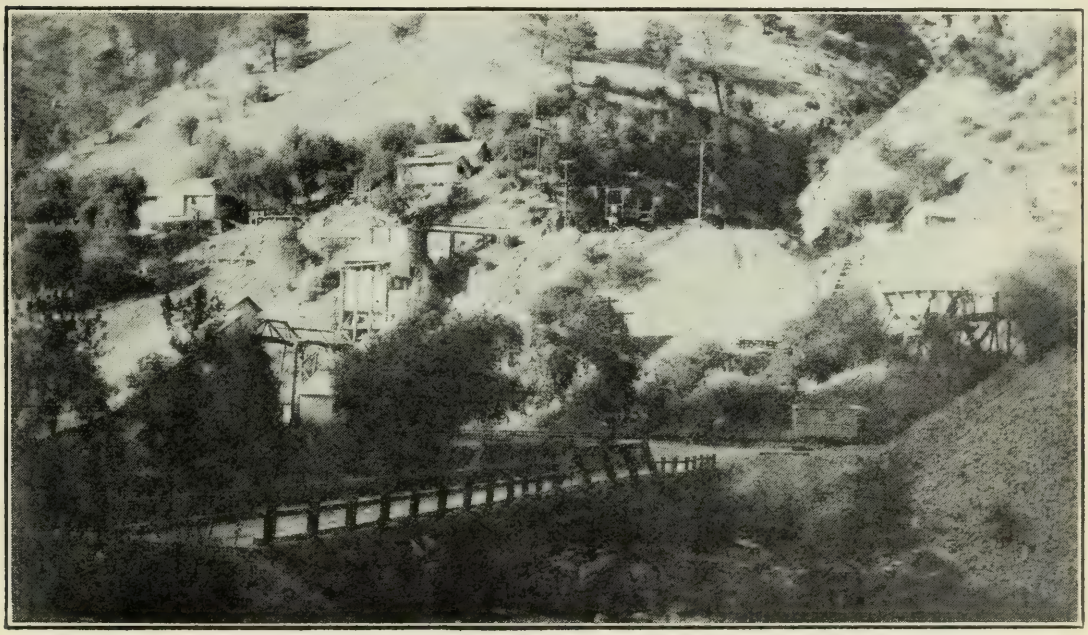
Odell Mining and Milling Corporation. This is a California corporation organized in March, 1927, with a capital stock of $250,000; George A. Odell, president; W. E. Condon, secretary-treasurer; address, 1109 Ingraham street, Los Angeles.

The company owns the Odell Group of 6 unpatented claims, situated near the confluence of Sherlock Creek and Merced River, in Sec. 14, T. 4 S., R 17 E., on what is known as Telegraph Hill. The discovery on which the corporation is based was made in November, 1924, since which time two adits have been driven. The upper adit is 80 feet in length and cut two veins at 35 and 70 feet, respectively. The first vein is about 18 inches in width and carries free gold with some 'specimen' rock. The other vein is a contact vein about 3 feet in width near a diabase intrusion. It has been drifted on 70 feet and is said to show good milling values. A lower crosscut adit, 175 feet in length, intersected the veins at 55 feet and 135 feet from the portal. An intersecting vein cutting the formation almost at right angle was developed in this working. A road to the property, which is about 1500 feet above the level of Merced River, is being constructed. This property was not visited. A detailed report by Bedford and Hind, mining engineers of Los Angeles, may be seen at the company's office.

Onyx Mine consists of one mining claim and patented land surrounding it in Sec. 10, T. 6 S., R. 17 E., owned by L. H. Rowland and S. B. Givens of Cathay. There is a quartz vein 3 feet in width striking northwest and dipping slightly to the southwest. The quartz contains free gold and sulphides. The vein, which can be traced for a mile and a half, is opened up by a shaft 60 feet deep. Property is one and one-half miles from Yosemite highway and readily accessible. There is electric power within six miles and timber and water are available.

Original Mine. This gold mine is a good example of a well-managed, regularly producing and good dividend-paying mine: in fact, at the present writing it is the only metal mine in Mariposa County of which the above can be said. It is owned by Original Mining and Milling Company; H. W. Banks, president; C. E. Kocher, secretary and treasurer; G. M. Egenhoff, manager, and J. W. Warford, mine superintendent; home office, Merced; mine address, Clearing House. The company was incorporated in 1911, with a capital of $200,000, and except for a few very short interruptions, it has operated continuously since 1911. The company's stock is held closely and little publicity has been given to their operations.

The Original Mine is located at Clearing House on Merced River and Yosemite Valley Railroad, about six miles west of El Portal, in Sec. 21, T. 3 S., R. 19 E. Elevation at the railroad is 1500 feet, but the surface is rugged and rises steeply toward the north. There is very little timber. Water is obtained from the river.



Original Mining and Milling Company's property, showing mill in left foreground. Clearing House, Mariposa County.

The property consists of ten claims, all patented. The four original claims were located in 1908 and the others acquired later, some by purchase. There is one vein averaging 2 feet in width, but having a maximum width of 6 to 10 feet in places on the lower levels. Hoisting is through a two-compartment inclined shaft, 1100 feet in depth with ten levels. There are 670′ of drifts on the first level, 1200′ on the second, 1300′ on the third, 1250′ on the fourth, 660′ on the fifth, 1700′ on the 650-ft. level, 1200′ on the 750-ft. level, 700′ on the 850-level, 1600′ on the 950-level and 1300′ on the 1100-level; also one crosscut of 1300′ and 1000′ of raises and many stopes. The crosscut taps the Ferguson vein (Anderson Mine) now a part of the Original Company's holdings.

The Original vein strikes northwest and dips 75° NE. In the lower levels the shaft is in the hanging wall. Two faults were encoun-

tered on the 950- and 1100-ft. levels, which cut off the vein for a distance of 110′, but it was picked up again on the lowest level where it was 6 to 10 feet wide. Four ore-shoots have been developed, the longest 100′ to 125′ in length and the others 50′ to 75′; all pitch to the north at about 45°. At present a winze is being sunk in the vein from the 1100-ft. level, 150′ north of the shaft. Very little timber is required, as the ground stands well. The mine makes only a little water.

The country rock is mainly Calaveras slate, but the Calaveras formations are intruded here by granite, and although no granite appears on the surface the vein runs from the slate into granite, crossing the contact without interruption, and in the lower levels both walls are granite. The ore is a dark, free-milling quartz carrying about 2% sulphides.

Equipment includes a 30-h.p. electric hoist and a 12″ by 18″ I.-R. compressor. Besides the mill, there is an office, boarding and lodging houses, superintendent's house, several cottages, blacksmith shop, assay office and a power house. Power is supplied by the San Joaquin Light and Power Company. The local plant, which is operated by water-power brought through a 1900-ft. flume capable of carrying 6000″, being held for emergency use, or if water is available, for operating the compressor.

There is a 10-stamp mill, with Blake crusher, Challenge feeders, two 4′ by 16′ plates and one Deister and one Overstrom concentrating table. The ore is crushed to 40-mesh in the batteries, from 30 to 35 tons per day being handled. Concentrates are shipped to a smelter.

The following excerpts are taken from the annual report of the company's operations for the year ending December 31, 1926:

Development

Development work in 1926 was directed principally to the lateral exploration of the vein at the 950 and 1100 levels.

At the beginning of the year 1100 north drift had passed through No. 1 orebody and was about to enter No. 2 orebody, which joined the former. The drift was extended 422 feet to a point 712 feet from the station crosscut, where the work was suspended to allow necessary raising and stoping operations to proceed. Drifting at this level disclosed a continuous body of ore 507 feet in length. This body, which ranges in width from one foot to eight feet, represents a consolidation at this horizon of the first three orebodies. Drifting will be resumed as soon as possible in order that the orebodies to the north may be opened.

A little work was done south of the 1100 station crosscut. The south drift was driven 18 feet. A narrow vein of quartz carrying a little value is exposed here.

Early in April drifting operations were resumed at the 950 level. 950 north drift was advanced 617½ feet to the present face, 1363 feet in. An interesting feature of this development was the appearance at 857 feet of an orebody which proved to have a stoping length of 156 feet. This orebody represents the downward projection of a short and narrow lens of quartz which, in 1922, was encountered in 750 north drift at 855 feet. The 950 drift is now being extended in to open the fifth orebody. It is expected that this oreshoot will be encountered very shortly.

In August new exploration was undertaken in 650 north drift. The drift was advanced from 1365 feet to 1518 feet from the station crosscut, a distance of 153 feet. Although no ore was encountered in this distance, conditions appear favorable for the occurrence of another orebody. It is planned to explore the vein further when circumstances permit.

Mining

During the year stoping of ore was in progress at the 750, 850, 950, and 1100 levels. The following tonnages of ore were hoisted:

Level	*Tons*	*Per cent of total tonnage*
750	2,825	24.3
850	3,008	25.9
950	3,530	30.5
1,100	2,248	19.3
	11,611	100.0

During the same period 3718 tons of waste was removed from the mine. This tonnage was produced principally in drifting and crosscutting operations. A considerable part, however, was sorted out from ore drawn from stopes.

At the close of 1926 the reserves of broken ore were somewhat lower than a year ago. Broken ore in stopes and raises on January 1, 1927, amounted to 6675 tons, which represents a decrease of 1693 tons from that on hand January 1, 1926.

The tonnage of ore in place (exclusive of broken ore reserves) is slightly less than on January 1, 1926. It is estimated that there is 14,435 tons of standing ore in the mine. Considerable additions will be made to this total during the coming year as the various orebodies are opened at the 950 and 1100 levels.

Milling

During 1926 the mill crushed 10,734 tons of ore, the average head value of which was $17.12 per ton. Some slight loss of operating time resulted from shut-downs caused by blasting on the highway. Except for this, the mill operated at maximum capacity throughout the year.

1550 tons of waste was sorted at the surface from ore going to mill.

Bullion obtained by amalgamation amounted to 9583.64 ounces troy.

Concentrates saved amounted to 55.26 tons, the metal content of which was

Gold	262.56 oz.
Silver	278.94 oz.

which represents an average value of $101.15 per ton.

The aggregate gross value of bullion and concentrates was $164,327.38. The net proceeds from the sales of both products totaled $162,411.88, the difference consisting of refining charges on bullion and smelter and freight charges on concentrates.

The average value (gross) recovered per ton of ore milled amounted to $15.30, the net return from which was $15.13.

The following summary, containing comparative data on production for the past three years, will be of interest:

	1924	*1925*	*1926*
Ore mined, tons	11,650	12,901	11,611
Broken ore in reserve, tons	11,101	8,368	6,675
Developed ore, tons	18,472	17,207	14,435
Ore milled, tons	10,351	11,094	10,734
Concentrates obtained, tons	41.19	37.495	55.26
Concentrates, value per ton	$118.21	$130.90	$101.15
Production, gross value	$150,872.41	$167,642.68	$164,327.38
Production, net value	$149,809.39	$165,499.16	$162,411.88
Value recovered per ton of ore milled	$14.58	$15.11	$15.30

Value recovered, per ton (8-year average), $13.81.

Oro Rica Mine (Pinon Blanco). This property consists of the Pinon Blanco, North Pinon Blanco, Old Judge, South Judge, Little Judge and mill site, patented claims, having an area of 95 acres, and the Star lode claim and Stephen placer unpatented claims, owned by the Oro Rica Mines Company, care of A. E. Towers, Metropolitan Club, New York. The mine is in Secs. 19, 20 and 29, T. 2 S., R. 16 E., about three miles north of Coulterville, near the northern boundary of the county. There are two contact veins, varying from three to six feet in width, between a slate footwall and diorite hanging wall. The strike is N. 20° W. and dip 65° NE. The outcrop of the vein and workings on the top of Pinon Blanco Ridge form a conspicuous landmark. The property is developed by a tunnel over 2000 feet long, with 900 feet driven on the vein. It is equipped with a 20-stamp mill, but litigation over ownership has resulted in the mine being idle for the past ten years.

Our Chance Mine consists of one claim, located in early days. It is situated in the Whitlock district in Sec. 29, T. 4 S., R. 18 E., about seven miles northwest of Mariposa. Owned by Albert Austin, of Mt. Bullion, who has held it about 20 years, during which time it is said to have produced $40,000. It has been worked as a pocket mine and has produced some beautiful gold specimens and also quartz crystals of good grade. There is said to be some milling rock on one end of the claim. The vein varies from 4 inches to 3 feet in width at the deepest part and contains considerable ribbon quartz. Development consists of a tunnel, 150 feet long, with several drifts, and a 70-ft. winze. A second tunnel is 75 feet long and has a 60-ft. winze. It has been worked by hand and the gold recovered in a mortar or by arrastra. The owner

has been harassed by stock-raising homestead claimants in recent years and wants to sell.

Permit Mine (Bull Dog) consists of the Boulder and Permit claims, the former in Sec. 23, and the latter in Sec. 31, T. 4 S., R. 18 E., in the Whitlock district, six miles northwest of Mariposa. Owner, Theo. E. Kockel, Mariposa, California. It is best reached by trail from Bear Valley. Most of the development consists of a shaft put down on the Permit claim in the course of doing annual assessment work. There is a vein here from 2 to 4 feet wide between porphyry walls. The ore is said to assay $30 a ton.

Pine Cone Mine (Bald Mountain). This property consists of one claim, situated in the Quartzburg district, seven miles northeast of Hornitos in T. 4 S., R. 16 E. The claim contains two quartz veins, one 6 inches to 1½ feet wide and the other varying from 1 to 2 feet in width. These unite and form a single vein about 2½ feet wide. It was first worked about 45 years ago. There has been considerable production from pockets, but nothing except assessment work has been done recently. Owner, F. A. Cavagnaro, Hornitos.

Pine Tree Mine is one of the 'Mariposa Grant' properties located midway between Bear Valley and Bagby in Sec. 9, T. 4 S., R. 17 E. The Pine Tree was one of the large producers in the early history of mining on the 'Grant.' It adjoins the Josephine, another famous producer, and they are usually worked as one mine. The elevation is 2070 feet, topography rough and sparsely timbered. The vein here averages ten feet in width; it strikes northwest and dips 55° NE. The footwall is slate with serpentine on the hanging wall. Development consists of a tunnel and 380-ft. shaft with approximately 5000 feet of drifts on four levels. When formerly operated on company account, the ore was milled in the Benton mill on Merced River at Bagby, also belonging to the company. More recently the Pine Tree and Josephine mines have been worked by lessees and the ore milled in the Princeton mill at Mt. Bullion. The total combined output from 1900 to October 31, 1915, was 29,968 tons, having a value of $371,749, an average of $12.40 a ton. There has been but little activity since 1915. However, in 1927 a lease on this mine and the adjoining Josephine was given to Thos. H. Lipps, 206 Financial Center Building, Los Angeles, president of the *Vallecito Mining Company.* The latter company is operating a rich gravel deposit in Calaveras County, and it is reported that this company will soon start work on the Mariposa properties.

Potosi Mine; owned by A. S. Bigelow and G. M. Hyans of Boston. (See under *Merced Gold Mining Company.*) The Potosi is situated 1½ miles west of Coulterville, in Sec. 4, T. 3 S., R. 16 E. The elevation is 1700 feet, surface fairly rough and with little timber. Water was obtained from the mine. There is one quartz vein, varying from 1 to 20 feet in thickness, between slate walls. It strikes northwest and dips 49° northeast. It was developed by a tunnel, 2500 feet long on the vein, an incline shaft, 350 feet deep, two air shafts, crosscuts, raises and stopes. The mine was partly unwatered in 1912 except for which there has been nothing done for many years. The 40-stamp mill and other surface equipment was destroyed by fire in 1926.

Princeton Mine. The Princeton is one of the most famous mines of the 'Mariposa Grant.' Owned by the Mariposa Commercial and Mining Company; E. H. Benjamin, president, 308 Finance Building, 580 Market street, San Francisco. The mine is located at Mt. Bullion, in Sec. 18, T. 5 S., R. 18 E. It was first worked in 1852. Writing in 1868, J. Ross Brown in his report to the Secretary of the Treasury [1] says, "The Princeton Mine has been one of the most productive in California, and has been noted for both the abundance and richness of its quartz. For a time it yielded $90,000 a month from milling rock, and this is more than any other mine of the state ever did. * * * The richest rock was found within 100 feet of the surface, where the pay was $70 a ton from milling rock, besides large numbers of specimens, of which it is said that not less than $100,000 in value were stolen by the miners."

There was an incline shaft 1660 feet deep with eight levels and a total of 11,418 feet of drifts previous to late operations by the Princeton Gold Mines Company, and the ore had been stoped from the 1200-ft. level to the surface.

From 1900 to October 31, 1915, the Princeton yielded $1,228,273.56 from 350,329.37 tons of ore, giving an average value of $3.50 a ton. The vein which was worked averaged eight feet in width between slate walls. It strikes N. 35° W. and dips between 45° and 60° NE. The property was completely equipped and had a 40-stamp mill, all operated by electric power. Total cost of operating in 1914 was $2.71 a ton. In 1915 operations ceased and the mine remained idle until 1921.

Princeton Gold Mines Company Trust Estate Mines. In 1921 Theo. E. Kelso and Wm. H. Holmes contracted to purchase the Princeton Mine and a considerable acreage of 'Grant' land from the Mariposa Commercial and Mining Company. They later dropped the land purchase, but retained the Princeton Mine, giving a mortgage back to the 'Grant' owners as security. Holmes and his associates organized the *Princeton Gold Mines Company* and carried on an intensive stock-selling campaign, mainly throughout the eastern states. Work was begun at the mine. The 40-stamp mill was dismantled and parts used in rebuilding a 20-stamp mill on another site. Intermittent mining was carried on until 1926. While under their control the main shaft was sunk 670 feet and a drift was run west 800 feet at the 150-foot level on a vein which they supposed was the Princeton vein, but this is seriously questioned by those long familiar with the ground. Ore in this drift averaged $3 a ton. No drifting was done below the 300-foot level. Judging from results attained, these promoters appear much more adept at stock-selling than mining, the belief being current that stock sales netted several hundred thousand dollars and that the effective work accomplished at the mine could have been done for one-tenth of that amount. Apparently only enough was done to keep up appearances. The management was changed frequently, stock given for miners' wages, interest and payments were allowed to become delinquent, and finally in 1926 all work stopped except pumping. In the summer of 1927 a forest fire swept over the property and the mill

[1] Brown, J. Ross, Mineral Resources West of the Rocky Mountains, 1868.

was burned. This precipitated the end. The pumps were shut down and the mine is now filling with water. A foreclosure suit brought by the Mariposa Commercial and Mining Company in 1927 resulted in title to the mine reverting to the 'Grant' owners. Idle.

Prothero Brothers Mine was composed of eight unpatented claims owned in 1920 by Prothero Brothers and Belknap Brothers of Orange Grove, California. The claims were located in Sec. 3, T. 6 S., R. 19 E., on the West Fork of Chochilla River. The country rock is granite. Some work was done on them for several years, and in 1922 they were under option to Orlando Moore, Route B, Visalia. The claims were later abandoned, after several tunnels had been run in an endeavor to develop an orebody. The equipment, which consisted of a 60-h.p. gas engine and compressor, has been removed.

Quail Mine (Mammoth or Sunset) includes the Bull Dog, Bonanza Bug, Mammoth, Bonanza, Jumper, Sunset, Columbia and Eureka claims and 200 acres of timber land, located in Sec. 16, T. 3 S., R. 17 E., about eight miles southeast of Coulterville on Indian Gulch, which opens into North Fork Merced River. Owner, Frank J. Bruschi, Coulterville.

The topography in this area is rugged, the elevation at the mine being 2300 feet. There is plenty of water from springs, mine and in the gulch.

There are three veins which average 4 feet in width between a porphyry footwall and slate hanging wall. They strike northwest and dip 40° SE. The Quail Mine has been worked intermittently over a long period of years by the owner and various lessees. It was equipped with a 10-stamp mill, but this was destroyed by fire in 1917. In the latter part of 1919 it was being developed by M. A. Elftman, who was operating a Gibson mill.

The workings consist of a tunnel about 1000 feet long, one shaft 150 feet deep, another incline shaft 55 feet in depth and several stopes and raises. A total depth of 700 feet has been reached in the workings and there is said to be 30 inches of $14 ore on that level. It is idle at present.

Queen Specimen Mine. A 'Grant' property situated in Sec. 8, T. 4 S., R. 17 E., about one mile northwest of the Pine Tree and Josephine mines. The elevation is 1423 feet. The vein strikes northwest and dips northeast.

This mine was worked a little in 1925 by Wm. Deaner and others who had it under lease. About 500 tons of ore was milled. It is included in the lease covering the Josephine and Pine Tree mines recently granted to the *Vallecito Mining Company.* Idle at present.

Recorder Mine consists of the Recorder, Rex and Cherry Tree claims, located in the Colorado district in Sec. 20, T. 4 S., R. 18 E. Owner, Robert MacLean, Mariposa. Elevation, 2400 feet; surface rough with some timber. There is plenty of water from springs and from the mine. There is a quartz vein averaging 1 foot in width, between porphyry walls, which is worked intermittently as a pocket and placer mine. The vein strikes north and dips about 70° E. It is developed by an adit level and several hundred feet of drifts. (See Rex Mine, also.)

Red Bank Mine. One of the several properties above the north bank of Merced River northwest of Bagby. The Red Bank is in Sec. 36, T. 3 S., R. 16 E. Country rock is slate, mariposite and serpentine. The property is patented and consists of the Merced Placer, Stevenson, Daisy, Jubilee, Syndicate lode and Coolgardie placer claim, comprising 165 acres, 90 acres placer and 75 acres lode. The owner is Percy L. Pettigrew, 1227 Flood Building, San Francisco. It has been idle for a long time.

Red Bank Prospect is a pocket mine on the Mariposa Grant at Mt. Bullion. It is under lease to and is worked by Louis Marre of Mt. Bullion.

Red Cloud Mine. This is an old mine said to have had a production record of $1,500,000. It has not been worked for thirty years. It is located in Sec. 22, T. 2 S., R. 17 E., about nine miles east of Coulterville. The last known owner is Mrs. Emma McDiarmid of Coulterville. There is one vein from 1 to 3 feet in width between slate walls; strike east and dip 60° N. It has an incline shaft and 500 feet of drifts. Idle.

Red Oak Mine is a single claim, situated in Sec. 35, T. 3 S., R 16 E., two miles in an air-line west of Bagby. Elevation, 2000 feet. The location, which has been held by the present owner, J. E. Taylor of Bagby, for the past four years, is based on an early-day discovery. There is a quartz vein 2 to 3 feet wide, on which pan tests show good free gold prospects. It is developed by an open cut and tunnel 35 feet in length. There is a little timber on the claim and plenty of water from springs. Equipped only with hand tools, the owner working alone.

Revel Mine consists of one claim located at Sweetwater in Sec. 28, T. 4 S., R. 19 E. There are several veins about 2 feet in width, with granite walls. They strike east-west and stand nearly vertical. Development consists of a shaft 150 feet deep, several hundred feet of drifts and a stope 800 feet long and 150 feet high. Idle for years and the workings are badly caved.

Rex Mine (Rumley). (See also Recorder Mine.) The Rex claim is a relocation made in 1921 of the old Rumley and is a pocket mine. Owner, Robert MacLean, Mariposa. Occasional pockets have been taken out from the Rumley vein through a 52-foot incline shaft and drifts. The vein strikes north and is quite flat, dipping 30° E. It varies from 4 inches to a maximum of 18 inches in width. During 1927, in running a crosscut easterly to cut this vein below the bottom of the incline shaft, MacLean cut another flat vein which does not outcrop, varying from 2 inches to 2 feet in width, and dipping in the opposite direction, west; or this may be the Rumley vein broken over. In March, 1928, a short drift on this vein ran into a very rich streak and for a time the owner was pounding out $200 a day with a hand mortar.

Roma Mine consists of one patented lode claim and mill site containing 25 acres, located in Sec. 14, T. 4 S., R. 18 E., adjacent to the Yosemite Valley highway and about two miles south of Briceburg. Owners, M. A. and Frank H. Harris, Fifth and Brannan streets, San Francisco. Elevation, 2700 feet; surface rough with little timber. Water is available in Bear Creek. A power line passes within a few hundred feet.

There is one vein, about 2 feet in width, which strikes east and dips 60° S. Developed by a tunnel, 1000 feet long. The mine has not been worked for many years.

Rose Mine comprises two claims located one mile east of Mt. Bullion adjoining the King Midas Mine on the southeast. They contain the extension of the gold-bearing talcose ledges found on the former. Rose Mine claims are under lease to J. W. Stennett of Mariposa, and associates R. E. Silvear, Mariposa, and George Humes of Watsonville. The formations and character of the ore here are essentially the same as described under King Midas Mine. An incline shaft with gas engine hoist, which had reached a depth of 50 feet at the time of visit, is being put down on one of the talc veins. There is no milling equipment as yet. It is the intention of the owners to sink at least 300 feet. Two men are working.

Rutherford and Cranberry Group. The Rutherford and adjoining Cranberry Mine and mill site were patented in 1874 a few years after their discovery. Other claims have been consolidated with these and the group now comprises eight claims and mill site with a water right on the Merced River for 1500 inches of water. Owner, F. E. Bass, 2801 Union street, San Francisco. Some production was made during the 80's from shallow workings, the ore being worked in an arrastra. There has been little or no work for the past 25 years, but in September, 1927, a lease was given to R. A. Fredericks, of El Portal, who has started drifting on the Rutherford vein.

The property is situated in Secs. 15 and 22, T. 3 S., R. 19 E., the claims extending from Merced River northward toward the top of the rugged river canyon, the elevation ranging from 1560′ to 2650′. Yosemite Valley Railroad crosses the lower end of the property, the station at Incline being within 200 yards. Yosemite Valley highway is on the opposite side of the river. San Joaquin Light and Power Company's lines also cross the property. There is some oak and bull pine.

The country rock is granite, intruded by dikes of fine-grained diorite and accompanying gold-bearing quartz veins. Four veins have been proven mineralized and five others have not been prospected. The principal vein is 1 to 5 feet in width and carries free gold with some pyrite, arsenopyrite and a little galena. The foot and hanging walls may be either granite or diorite. They are firm and stand well. The strike is in general north-south and dip 70° to 80° E., but both strike and dip of the different veins and cross-veins may vary considerably. The main vein has been proven on the surface for several hundred feet and several ore shoots have been mined, one of which is stated to have milled $20 per ton. The greatest depth reached is 120′, by shaft; there are also tunnels 400′, 800′ and 100′ in length, with a little drifting and other underground workings. There is no equipment. The Original and Hite mines are the nearest developed properties, the distance to the latter being less than a mile.

Ruth Pierce Mine (Grimshaw). The Ruth Pierce was one of the four quartz mines, producing at the time the last previous report on Mariposa County was prepared (1920). The property consists of two claims on patented agricultural land, situated in Sec. 13, T. 5 S., R. 16 E., four miles by road east of Hornitos. Owner, *Tennessee Mining*

Company, c/o H. Ward Dawson, 833 Market street, San Francisco; formerly known as *Hornitos Gold Mining Company*, who took over the mine in 1916. It is one of the better known mines of the county and is developed by a shaft 600 feet deep with six levels. The first level has been drifted 350 feet, the second 640 feet, the third 600 feet, the fourth 305 feet, the fifth 1100 feet and the sixth 800 feet. When last active, one shift per day was working and 350 to 400 tons of ore, averaging $9 a ton, was milled per month. Tailings are said to run $2.50 a ton and about $20,000 worth are impounded. There are three quartz veins, 4 to 5 feet in width between slate and diorite walls. Their general strike is east-west and dip 65° N.

The property was equipped with a complete 10-stamp mill, 1050-lb. stamps, plates and Frue vanners. Electric power was furnished by the San Joaquin Light and Power Company for operating the mill, compressor and mine hoist. Operations have been intermittent in recent years. In 1927 the mill and some other surface equipment was destroyed by fire. Repairs are under way at present, a new gallows frame having just been completed.

San Domingo Mine (Buffalo) consists of one full claim, which has been recently patented. Owned by W. S. Zeller, 949 Excelsior avenue, Oakland. The mine is located in the Colorado district, in Sec. 13, T. 4 S., R. 18 E., eight miles northeast of Mariposa. The elevation is 3000 feet, and topography rough. There is some timber, but water is scarce. A vein of free-milling quartz, averaging 2 feet in width, strikes northwest and dips 50° NE., between a slate footwall and granite hanging wall. It is opened up by a few hundred feet of tunnel, with some raises and winzes. Idle.

Schoolhouse Mine consists of one patented claim, owned by Mrs. Carmela Maschio, located on the patented Maschio ranch land in Hunter Valley. The mine is in Sec. 10, T. 4 S., R. 16 E., about 12 miles north of Hornitos, or six miles by trail from Bagby. It is opened up by an incline shaft and there has been some drifting on the vein. It is equipped with a 2-stamp mill with concentrator, operated by a gas engine, a hoist with 20-h.p. engine, blacksmith shop, etc. About 1916 Milton Sutherland was operating it under lease but a disagreement arose and it was closed down. Mr. Sutherland again opened up the mine in 1923 and took out some extremely rich free gold ore which he had exposed on two levels. The vein is dark, free-milling quartz which lies between porphyry walls. There has been little doing since 1923.

Schroeder Group consists of four lode claims and one placer claim, a total of 100 acres, owned by J. A. and C. J. Schroeder of Mariposa, P. W. Judkins and C. H. Weston. The property is in the Colorado district in Sec. 16, T. 4 S., R. 18 E., two miles by trail south of Saxon Creek station on the Yosemite Valley Railroad.

Elevation, 2500 feet; topography rough and well timbered, but with little water available except in winter. There are several veins, varying from a few inches to 3 feet in width, with a porphyry footwall and slate on the hanging wall. Their general strike is north and dip 80° E. There is a nearly flat blanket vein, which cuts the other veins. The mine is usually worked some each winter through an open cut over 400 feet long and 60 feet deep, and several hundred feet of drifts, the

material being worked down to the blanket vein. Equipment consists of a 5-ft. Huntington mill, run by a Knight water wheel, track, cars, blacksmith shop and boarding house.

Sebastopol Mine comprises one claim situated in Sec. 32, T. 5 S., R. 19 E., about 1½ miles southwest of Bootjack. Formerly owned by L. L. Hart of Mariposa, but recently purchased by Belle McCord Roberts, Long Beach, California. There is a strong quartz vein on the claim, which has been prospected both on the surface and by tunnels. The vein is in the contact zone between slate and the granite intrusion which extends on to Raymond and forms a part of the Sierra batholith. Samples from the Sebastopol Mine are reported as follows by Techow and Davis of Sacramento:

North face of vein in tunnel 100′ from portal 5′ wide	Gold	$3	29
Streak of quartz on footwall north face of vein in tunnel	Gold	2	45
South face of vein in tunnel, 5′ wide	Gold	2	07
Streak of quartz in south face in tunnel	Gold	1	65
Picked sample quartz in tunnel	Gold	5	60
Quartz vein 2′ wide near granite contact	Gold	3	72
Shallow cut on surface 80′ above tunnel	Gold	2	06

Sierra Rica Mine consists of the Sierra Rica, King Solomon and King Solomon mill site, patented claims and the Barbara and Muriel unpatented claims. The property is situated in Sec. 14, T. 4 S., R. 18 E., about 2 miles south of Briceburg, on the Yosemite Valley highway. Owner, J. M. Graham and Amelia Wilson, 256 North Sixth street, San Jose. The elevation is 2800 feet, with rugged surface. Timber is scarce, but water can be obtained from Bear Creek and from springs.

There is one vein, averaging 4 feet in width on the contact between a porphyry footwall and slate hanging wall. Its strike is northeast and dip 70° SE. On the Sierra Rica there is a 450-foot tunnel and a 125-foot raise: on the King Solomon a 70-foot tunnel and a 60-foot raise, with some drifts on both. A little prospecting and drifting was done in 1919 but the property has not been worked to any extent recently. An electric power line crosses the claims and there is some equipment, including a 4-stamp mill, ore cars, blacksmith shop, boarding house and dwelling. There is about 100 tons of ore on the dump, assaying up to $50 a ton. Reported to have had an early production record of $300,000.

Silver Bar Mine. (See under Silver.)

Silver Lead Mine. The old Honeycomb, St. Gabriel and Silver Lead lode claims which were first located in the 60's were bonded in 1914 by W. A. Bradley and associates of Carson City, Nevada, under the name *Mariposa Mining and Milling Company.* This company put on a 5-stamp mill with 850-lb. stamps, plates and two concentrators run by electric power supplied by the San Joaquin Light and Power Company; also a compressor with 75-h.p. motor, air hoist, pumps, blacksmith shop and other equipment. They operated for about three years, and then shut down for two years. There is one quartz vein carrying free gold and sulphides in diorite country rock. It averages 1 foot in width, strikes northwest and dips 42° NE.; proved on the surface for 3000 feet. The vein is opened by a shaft 250 feet deep with two levels and about 500 feet of drifts.

The property is in Sec. 34, T. 4 S., R. 16 E., in an area of rolling

hills about five miles northeast of Hornitos. Elevation 1200 feet. No timber. Water is obtained from the mine and a spring.

In 1919 the property was again unwatered, preparatory to starting operations. It was active in 1920. The last operations were carried on under the name *Simpson Mining Company,* W. A. Bradley, superintendent. This company quit in 1922, and since then all machinery has been removed and the property has remained idle.

Spencer Mine. This mine comprises a single patented claim, located in Sec. 29, T. 4 S., R. 18 E., in the Whitlock district, about seven miles northwest of Mariposa. It is owned by Ada I. Harris, c/o A. E. Dart, 1728 Broad street, San Luis Obispo. Dart has been working the property during 1927.

The elevation is 2500 feet; topography rough, with plenty of timber for mining. Water is obtained from the mine and Whitlock Creek.

There is a quartz vein averaging 5 feet in width, which strikes northwest and dips 80° NE. The footwall is diorite and the hanging wall is slate. The vein is developed by a 150-foot crosscut, a 50-foot winze and a stope 350 feet long by 150 feet high. Equipped with track, cars, pump, blacksmith shop and cabin. There is no mill, but the Austin group 10-stamp mill is located only a short distance away.

Spread Eagle Group comprises five claims and a fraction, the Spread Eagle, Empire, Miners Hope, Mohawk, Monarch and Tollgate Fraction, located in Secs. 29 and 32, T. 4 S., R. 18 E., in the Whitlock district, about six miles by road north of Mariposa. These claims have been held by various owners in the past as separate mines. More recently they have been owned by Nick Mullin of Mariposa. In 1927 Mullin sold the group to Belle McCord Roberts of Long Beach, California, the present owner. Intermittent work has been carried on here over a long period. The most recent activity, aside from assessment work, was in 1918, the ore at that time being milled in the Austin mill, $1\frac{1}{4}$ miles distant.

The formations in the Whitlock district are slate and greenstone. Most of the veins occur in the greenstone, but in some of them slate forms one wall. There are several veins on the Spread Eagle Group, varying from 2 to 6 feet in width. Those on the contact of slate dip to the east, while those in the greenstone stand nearly vertical. There has been a large amount of work done on this property, but most of the old workings are inaccessible. On the Spread Eagle there was a 210-ft. shaft with two levels and nearly 1000 feet of drifts on the vein. The Spread Eagle adit level follows a vein for 1000 feet, but does not reach a depth of over 100 feet from the surface. The Miners Hope tunnel is 50 feet below the Spread Eagle. It intersects a 3 to 6 foot flat vein dipping east, which has been drifted some distance.

Equipment on the property includes a 5-stamp mill with plate, air compressor and gas engine, all in fair condition. Water is available from a creek and springs, and electric power is within three miles. The following are assays of samples reported by Techow and Davis, Sacramento:

Vein exposed by placer workings	Gold	$5	75 a ton
North drift Miners Hope tunnel vein, 4 feet	Gold	4	86 a ton
Miners Hope tunnel, north face 3 feet	Gold	8	24 a ton
Spread Eagle tunnel 18″ quartz on hanging wall	Gold	7	20 a ton

Stockton Creek Mine is another of the 'Mariposa Grant' prospects, situated in Sec. 24, T. 5 S., R. 18 E., one-half mile east of Mariposa. There are two veins of free-milling quartz, each about 2½ feet in maximum width. The country rock is diabase. The main vein strikes east and dips 45° S. and is probably an extension of the Mariposa vein, worked in the Mariposa Mine. Workings consist of an incline shaft 135 feet deep, with two levels, the upper drifted 250 feet and the lower level 300 feet; one stope about 100 feet long by 70 feet high and 3 feet wide. The discovery was made in the 50's. Subsequent to early operations, it was worked a little by lessees at intervals between 1900 and 1915, the total output during this latter period being 592 tons, which averaged $19 a ton in value. All equipment has been removed, and it has now been idle for over ten years.

Sweetwater Mine. This property is located at Sweetwater, in Secs. 17 and 20, T. 4 S., R. 19 E., and comprises ten lode claims. Owned by C. A. McCartney, Jerseydale. It is an old property and has been worked at intervals for many years. In 1919 it was under bond to *Dominican Mining Syndicate, Inc.;* H. L. Schultz, president, and W. J. Minville, secretary, Coalinga, and the 10-stamp mill was being overhauled, preparatory to beginning operations.

There is a quartz vein, which swells and pinches, but averages about 2½ feet in width, in granite. It strikes northwest and dips 45° SW. A slate formation occurs just north and west of the mine.

The elevation is 3800 feet. The topography is rugged and the surface well timbered. Water is piped from the head of Sweetwater Creek.

The mine is developed by an incline shaft, 170 feet deep, with a level at 123 feet. There are 1200 feet of drifts, a crosscut of 600 feet and several raises and stopes. Besides the mill, there is an assay office, blacksmith shop, boarding house, bunkhouse and other buildings. Idle.

In March, 1928, McCartney reported that he had sold the mine to Frank Zichosch and associates of San Francisco, and that the new owners expected to start work at once.

Trabucco Mine comprises 80 acres of patented land situated in the Colorado district and reached by a one-mile trail from the new Yosemite highway. Briceburg is the nearest town. This property was recently purchased by Belle McCord Roberts, Long Beach, California, from Peter Trabucco, whose family owned it for many years. The property was not visited. According to a report made for the present owner by Walter Techow of Sacramento, a quartz vein averaging 5 feet or more in width, which has been traced for more than a mile, passes through the property, 2000 feet of the vein being within this ground. The main vein is on the contact of granite and slate. It dips to the east and is intersected by a number of cross veins coming in from the granite on the east, the latter veins dipping to the south. Most of the work done in the past was on the cross veins near the intersections where high-grade specimen ore occurred. This was recovered with mortar and pestle. The workings are all shallow. Water and timber are found on the property, and there is a power line within a short distance.

Samples taken from the remains of old dumps assayed as follows:

From cross vein dump—
No. 1 ---------- Gold $6 58 a ton
No. 2 ---------- Gold 7 20 a ton
From main ledge dump ---------- Gold 4 12 a ton

Turner Group comprises three claims, which parallel the Monte Christo Group in Sec. 20, T. 4 S., R. 20 E., about four miles east of Jerseydale. The vein carries free-milling ore with occasionally a little galena. It is being developed by the owner, A. E. Turner of Jerseydale.

Tyro Mine (Rittenhoffer) consists of one patented claim, located in Secs. 9 and 10, T. 3 S., R. 16 E., about four miles north of Coulterville. It is owned by A. M. Easton, 225 Mills Building, San Francisco. The elevation is 2300 feet, and the country rugged, with very little timber or water. There is one vein, 2 feet in width, between slate walls. It strikes northwest and dips 60° NE. The mine is developed by a 700-foot shaft, with six levels, 1400 feet of drifts and several raises and stopes. It has not been worked for many years. An old 10-stamp mill and other equipment formerly on it has been removed.

Uncle Jim Gold Mine comprises the Uncle Jim Group of eight claims, including placer and quartz, and the adjoining *West Point Group* of four placer and quartz claims. Owner, Wm. H. Rykert, 778 Ruthupham avenue, Rose Hill Station, Los Angeles; mine address, Clearing House. These holdings are situated at the junction of the South Fork with Merced River. The placer ground was first worked in the early days. Indian White Water Springs and the South Fork of Merced River would furnish water for hydraulicking and sluicing. Old ditches on the property are in bad shape, and only a little hand work is being done. The concrete bridge over the South Fork on the new Yosemite highway crosses the claims. The State Highway Commission maintained a large construction camp on the property during the building of the highway and bridge, which delayed development operations for the past three years.

Virginia Mine (Virginia-Belmont). This is one of the more important Mother Lode mines of Mariposa County that has been productive in recent years. It was formerly owned, and operated from 1912 to 1919, by the *White Gulch Mining Company,* now defunct. Their successor, the *Virginia-Belmont Mining Company,* 314 Kohl Building, San Francisco, which was incorporated in Nevada in 1920, acquired the property and operations were continued steadily until 1923, when this company closed the mine down. It remained idle until late in 1927, when it was taken over by *Nevada Hills Mining Company, Reorganized,* a well-established operating company; address, 208 Reno National Bank Building, Reno, Nevada; branch office, 321 Grant avenue, San Francisco; H. G. Humphrey, president; H. Z. Peters, secretary-treasurer.

The Virginia Mine comprises five patented claims, the Virginia, Virginia No. 2, Piedmont, Claremont, and August Belmont, having a total area of 100 acres; also the Coe Gulch placer claim. The property is in Secs. 13 and 14, T. 3 S., R. 16 E., three miles south of Coulterville, or eight miles by road north of Bagby, the nearest railroad station. The road from Bagby to Coulterville passes the property.

The vein in the Virginia varies in width from a narrow seam to a wide ledge, often swelling into lenses. It strikes a little west of north and dips 65° easterly, following the contact of serpentine on the footwall and diabase on the hanging wall.

There is a 1000-ft. shaft with adit level, over 6000 feet of drifts, with numerous crosscuts, raises, winzes and many stopes. One ore shoot is said to have been continuous from the surface to the lowest level (683 feet vertical) and a winze from this level, in the shoot, 100 feet deep showed ore averaging $25 a ton in gold, with a little silver. The average value of all ore milled in 1918 was $17.50 a ton. Compared with many other Mother Lode mines, the deepest workings here are very shallow and the vein has been developed for only a small portion of its length.

The mine is completely equipped with a 10-stamp mill (1080-lb. stamps), Blake rock-crusher, Challenge feeders, two plates 4 by 16 feet, two concentrators, 3½-ft. Hardinge mill, and a third plate. Tailings from the concentrators were reground in the Hardinge mill and then passed over the last plate. The mill and mine are equipped for operation with electric power. There is a 50-h.p. Ingersoll-Rand compressor, No. 5 I.-R. drill sharpener, air-drills, cars, track, pumps, a blacksmith shop, office, boarding house, residences, etc.

The new owners put a crew at work in the latter part of November, 1927,[1] and began overhauling the mill and opening up the upper levels, preparatory to complete unwatering of the mine. A good tonnage of milling ore is reported exposed in the upper workings and the mill will probably be started before the mine is entirely free from water. Operations are under the direction of Mr. R. K. Brown, mine superintendent.

Washington-Buena Vista Group. This group comprises five claims: Buena Vista (Busch), Washington, Phoenix, Lucky Lindy and Charles, located in Sec. 21, T. 4 S., R. 18 E., in the Colorado district. Owned by Belle McCord Roberts, Long Beach, California. Most of these claims have not been worked for many years. Some mining equipment was put on them by former owners as late as 1919, but no production was made. The elevation is 3000 feet. Water can be obtained from the mine and springs. An old shaft on the Washington claim is standing full. There is also an old 4-stamp mill here and steam hoist of little value.

A strong quartz vein coursing a little north of west can be traced for a mile through the group. Most of the former workings on it are on the Washington and Buena Vista ground. The vein is from 2 to 7 feet in width between slate walls.

The following are the results of assays made by Techow and Davis of Sacramento, who recently examined and sampled the vein for the present owner:

Washington claim, shallow shaft, ore 2½ ft. wide	Gold	$32 96 a ton
Buena Vista tunnel, 7 ft. of ore	Gold	8 24 a ton
Buena Vista tunnel, 7 ft. of ore	Gold	12 36 a ton
Buena Vista tunnel, 6 ft. of ore	Gold	10 40 a ton
Buena Vista dump, old shaft	Gold	6 40 a ton

In the latter part of 1927 two men were employed and an old tunnel, apparently run on a parallel stringer vein, and a crosscut to the main

[1] Reports received in March, 1928, after the above was written, state that the mine has been unwatered to the 500-ft. level and some excellent orebodies opened up; that the mill is operating, and that 21 men are employed.

vein were cleaned out. Where intersected by this crosscut the vein showed 5 to 6 feet of milling-grade ore, and a drift along the vein for 20 feet showed no marked change. The work of cleaning out the tunnel beyond the crosscut was then begun and it was reopened for a distance of about 100 feet beyond the first crosscut, where it was turned southeasterly to the vein and another westerly drift on the vein started. This drift showed increasing values and at a distance of 20 feet a sample showed several hundred dollars a ton in free gold and the vein fully eight feet in width. The last few feet driven in March, 1928, exposed a face liberally sprinkled with visible free gold. Grab samples and pannings indicated values up to several thousand dollars a ton. As rich ore is said to have been found in an old abandoned shaft 200 feet distant, it is possible that this discovery is on one end of a rich ore shoot of considerable size.

Electric power is available within a few miles.

Washington No. 2 Mine is an old property that has not been worked for many years. It consists of three patented claims, the Washington, Josephine and Jenny Lind, totaling 40 acres, and situated in Secs. 4 and 5, T. 5 N., R. 16 E., about five miles north of Hornitos. It is said to have been a very large producer in the early days, and the deepest mine in that district, when operated. There is an incline shaft, 1500 feet deep. The vein strikes north, dips 65° E. between slate walls, and is stated to have been 12 feet wide. It is owned by Mrs. Emeline Parker and the Mariposa Land Co., 19 Bacon Building, Oakland, California.

West Point Group. (See Uncle Jim Gold Mine.)

Whitlock Group. This group consists of three claims, patented in 1897, the Whitlock, Alabama and Westward, owned by Dr. F. E. Gallison and Lizzie Sain, 2821 Cherry street, Berkeley; total area, 45 acres. They are located in the Whitlock district, in Sec. 32, T. 4 S., R. 18 E., six miles northwest of Mariposa. The elevation is close to 3000 feet, surface quite rugged and not much timber, but there is sufficient water to run a 20-stamp mill.

Three quartz veins, averaging 4 feet in width, occur in greenstone country rock. Development consists of a 900-foot shaft with four levels, about 3000 feet of drifts, an 1800-foot drain tunnel and other workings. The mine was at one time completely equipped with a 20-stamp mill and considerable ore has been stoped. Steam power was used, and with wood at $4.25 a cord operations would not pay, and the mine was shut down in 1899. The 20-stamp mill and all equipment is now gone. There is said to be a large tonnage of $4 ore still in the mine.

Yellow Metal Mining Company. This company is now operating the Yellow Metal group of four unpatented lode claims, formerly known as the *Live Oak Mine;* situated in Sec. 17, T. 4 S., R. 18 E., in the Colorado district. Address, Yellow Metal Mining Co., 40th and Hollis streets, Emeryville; Richard Jeffrey, Briceburg, California, superintendent and manager. There are two veins, one averaging 2 feet and the other 8 inches in width, on the contact between a greenstone footwall and slate hanging wall. The strike of the veins is north and their dip 45° E. The ore is free-milling quartz.

Development consists of four shallow shafts, a 200-foot crosscut and drifts on the veins. The mine has been recently equipped with a new 2-stamp Hendy mill, which is crushing ore from the 2-foot vein that is being drifted from one of the shafts. The milling results are reported to be satisfactory.

GOLD (PLACER MINES)

The gold placers of Mariposa County were exceedingly rich and the placer diggings swarmed with miners in the days when the length of a claim on many of the gulches was the distance a man could reach with his shovel. The great majority of these were shallow deposits in present-day channels and bars; the extensive auriferous Tertiary and Cretaceous channels preserved under lava flows farther north along the western slope of the Sierras not being developed here; neither are the immense banks of distributed gold-bearing gravels, such as were hydraulicked on an extensive scale farther north, found in Mariposa County. There has been no extensive development of water supplies or ditch systems constructed in this area, but remnants of small ditches can still be seen along many of the gulches. Some fairly large gravel deposits are found, however, in Pleasant Valley north of Merced Falls and some activity was noted in this district in 1927.

Tacoma Mining Company. George W. Tobin, Box 95, La Grange, California, and associates have secured a lease on 2600 acres of the Prouty Ranch in Secs. 5 and 6, T. 3 S., R. 15 E., known as the *New Year Diggins.* Work preparatory to hydraulicking was begun in 1927, operating under the name of Tacoma Mining Company.

The deposit is eight miles southeast of La Grange and seven miles northeast of Merced Falls. There are estimated to be from 350,000 to 400,000 cu. yd. of gravel available. At the deepest point found it is 47 feet to bedrock. Most of the gold is rather fine and a little platinum occurs with it. The average value is stated to be from 75¢ to $1 a yard. Quartz seams in the porphyry have been worked for pockets at times in the past and a number of small pockets taken out.

As water is not abundant, the company first proposed to build a storage reservoir and sluice by pumping from the reservoir to a total height of 200 feet, but later decided to do away with pumping, and bring water from Browns Creek through a pipe line, 2500 feet in length. This 12-inch wood-stave pipe was being installed in November, 1927.

Huelsdonk Placer. In 1926 W. A. Huelsdonk operated one of his Huelsdonk concentrators on an adjoining gravel deposit and recovered fine gold and platinum. The gravel was sluiced down to the machine by water supplied by a 2-inch pipe line and pump.

IRON

Iron ore, mainly magnetite, has been found as float and in small quantity at a number of localities in the county, but it is probable that no commercial deposits exist here.

Masses occur at the base of Mt. Hoffman, in Yosemite National Park, and small quantities have been found on Big Spring Hill, three miles east of Mariposa.

Arthur J. Giles of Hornitos has submitted samples from that vicinity and it occurs as gossan associated with the copper deposits in the southwestern part of the county.

MANGANESE

No manganese ore was produced in Mariposa County even during the late World War period when this ore was in strong demand, but several occurrences have been noted. It has been found at Jasper Point; in small masses in Hunter Valley; in the first gulch on the north side of Merced River west of the Mountain King Mine, and in small amount with jasper in Indian Gulch in Sec. 23, T. 3 S., R. 17 E. Most of these deposits are of doubtful commercial value on account of lack of size, uncertain grade, or their inaccessibility.

PLATINUM

Platinum was reported discovered in 1919 in Devils Gulch on claims located in Secs. 1 and 12, T. 4 S., R. 19 E., five miles by trail from Jerseydale. The ore was said to assay $90 a ton in platinum, $44 in gold and to carry small amounts of cobalt, nickel and tin.

It is also reported to occur on a claim of the Little Wonder Mining Company in the same district.

These supposed occurrences have not been confirmed by the Division of Mines and Mining.

QUICKSILVER

Cinnabar occurs in small quantity associated with gold quartz in a 6-inch ledge on Merced River, near Coulterville, but it is not in sufficient quantity to be of value as a source of quicksilver.

SILVER

Silver Bar Mine (Silver Mine; also Bryan Mine). Property consists of four claims, the Silver Bar No. 1, 2, 3 and 4, owned by Susan McNally, Mariposa. The mine is in Sec. 15, T. 6 S., R. 19 E., about three miles south of Bootjack and six miles by road southeast of Mariposa.

A. D. Lane et al., Mariposa, took the mine under lease and bond in August, 1927, since which time they have started development, carried on metallurgical tests and begun reconstruction of the mill on a new site near the shaft.

The deposit is a fissure vein in granite, with a maximum width of 15 feet at the east end of the claims. It strikes nearly due east and dips 70° N. Sugar quartz occurs in the upper portion of the vein. The ore carries an average of $5 in gold and 20 oz. of silver, mainly in the form of argentite and various antimonial and arsenical silver sulphide minerals. In places it is heavily mineralized.

LIST OF PATENTED MINES WITH OWNERS' NAMES, FROM COUNTY ASSESSOR'S TAX LIST.

Name	Lode or Placer	Owner	Acres	Location		
				Sec.	T.	R.
		A				
Alabama	------	See Whitlock.				
Alta	------	See Sweetwater.				
American Eagle	------	⅓ H. L. Kopp, R.F.D. 1, box 343, Campbell; ⅓ John B. Morrison, and ⅓ Emelia J. Vallerdi, Pine Grove	20	30	4	16
August	------	See Virginia.				
		B				
Badger	------	See Grand Prize.				
Barium No. 1	------	See East Baryte.				
Bear Creek Group	------	Ben C. Hill, c/o Best Steel Casting Co., Hobart Bldg., San Francisco	67	21, 28	2	17
Belmont	------	See Virginia.				
Big Lode	------	½ James and John Lindsay, ½ E. A. Wheeler, Coulterville	9	29, 30	3	17
Bill Jones	------	See McCall.				
Blue Bell, Bonanza	------	½ John B. Morrison and Emelia J. Vallerdi, Merced; ½ Emelia J. Vallerdi, Pine Grove	40	30	4	16
Blue Lead	L	Mrs. M. H. S. Bannister, c/o R. B. Harper, 8 Porter Bldg., San Jose	20	13	5	16
Bogan and Baitelle	L	Mrs. M. H. S. Bannister, c/o R. B. Harper, 8 Porter Bldg., San Jose	6	26	4	18
Bonanza	------	See Blue Bell.				
Bondurant	------	Eva L. Fenn, et al., 24 La Salle Ave., Trenton, N. J.	20	25	2	17
		C				
Carrie Todd	------	Estelle I. Fraser and Geo. Frank, Coulterville	20	7, 8	3	18
Century	------	See Hasloe.				
Champion	------	½ Mrs. N. C. Ray; ¼ Mrs. Mary A. Mentzer, Coulterville, et al.; 1/6 Mrs. Permilia P. Hagar, Coulterville	15	28	2	16
Claremont	------	See Virginia.				
Colorado	------	Mrs. Emma Dearborn, 328 2d St., Richmond, et al. (⅓ P. W. Jenkins) ⅓ Chas. H. Weston, 433 9th St., Richmond	7	27	4	18
Compromise, Eubanks	------	Marble Spring Gold Mining Co., 547 Central Ave., Alameda	42	30, 31	2	18
Cons. Eureka, Lafayette and Eastern Star	------	Columbus Cons. Gold Mining Co., c/o C. Dondero, 5220 Genoa St., Oakland	60	8, 9	3	16
Coolgardie	P	See Merced Placer.				
Copper King and M S.	------	See Goodview.				

Copper Queen		California Copper Producers Trust et al., c/o A. B. Smith, 629 Call Bldg., San Francisco	20	3	8	18
Costa Placer		See La Victoria.				
Cranberry, Rutherford and M. S.		F. Bass, 2801 Union St., San Francisco		15, 22	3	19
Crown Peak and M. S.		Geo. E. Gamble, 1431 Waverley St., Palo Alto		35, 36	3	16
Crown Point		See Goodview.				
		D				
Daisy		See Merced Placer.				
Diltz and Mann, Vanderbilt	L	Mrs. Jennie E. Diven, 147 Kempton Ave., Oakland, et al.		1, 2, 11, 12	5	19
				29	4	18
Domingo and M. S.	L	Geo. Barrett, Coulterville	25			
Doss		L. A. Ginaca, Hornitos		28	5	16
Duncan		Geo. D. Turner, Hornitos	44	16, 21	5	16
		E				
East Baryte, North Barium, South Barium, Barium No. 1		El Portal Mining Co., Thos. Turner, Secy., 910 American Bank Bldg., San Francisco		18, 19	3	20
Eastern Star		See Cons. Eureka.				
Enterprise		Enterprise Mining Co., c/o R. Bancroft, Merced.		2	5	16
Eubanks		See Compromise.				
Excelsior Group	P	James Burns, c/o Merced Irrigation Dist.	67	17, 20	3	16
		F				
Feliciana and M. S.	L	Morris Farber, 462 Phelan Bldg., San Francisco	20	7, 17	4	19
Francis		Olcese Estate Co., c/o St. Louis Olcese, Bakersfield	30	19, 30	6	18
Fremont Drifting and Mining Co. Placer		B. A. and Everett Bagby, Bagby	41	6	4	17
		G				
Garibaldi		W. R. English, Box 333, Sonora	20	4, 9	3	18
Geare		Jesse S. L. Potter, c/o J. S. Potter, 214 American Bank Bldg., San Francisco	20	30	4	18
Georgia Point and M. S.		See Spring Tunnel.				
Giltner and M. S.		See Hite and M. S.				
Golden Eagle	P	Mrs. Annie M. Peterson, Mariposa	60	3	5	19
Goodview, Rothschild, S. A., Sunset, Crown Point, Little Giant, San Jose, Stonewall Jackson, Copper King and M. S.		Samuel L. Thrift, Lydia J. King, Catherine M. Thorne, 420 Channel St., Stockton	165	5, 8, 9	8	18
				32	7	18
Grand Prize, Badger		Oaks and Reese Mining Co., Hornitos	26	4	4	16
				33	3	16

LIST OF PATENTED MINES WITH OWNERS' NAMES, FROM COUNTY ASSESSOR'S TAX LIST—Continued.

Name	Lode or Placer	Owner	Acres	Location		
				Sec.	T.	R.
		H				
Hasloe, Century	------	J. S. Morgan and Sons, 614 3d St., San Francisco	40	1, 2	3	17
Hite and M. S., Priest, McConley and M. S., Giltner and and M. S., Summit and M. S., Old Dominion	------	James S. Spillman, 244 Kearny St., San Francisco	60	22, 26, 27	3	19
Hite Central and M. S.	L	Dr. Owen Buckland, 391 Sutter St., San Francisco; Margaret Poyzer, et al.	------	22, 27	3	19
		I				
Indian Gulch	L	Campbell and Carr, 2225 E St., Bakersfield	20	34	5	16
		J				
Jenny Lind	------	See Washington.				
Josephine	------	See Washington.				
Jubilee	------	See Merced Placer.				
Juniper	L	A. Zirker, Box 554, Merced	20	19, 30	4	17
		L				
Lafayette	------	See Cons. Eureka.				
La Victoria, Tandeur and M. S., Costa Placer	------	Mrs. Susan A. Lang, 2253 Fulton St., San Francisco	40	4, 10	4	16
Little Giant	------	See Goodview.				
Little Judge and M. S.	------	See Pinon Blanca.				
Louisiana	------	C. P. Treat, 426 Palo Alto Ave., Palo Alto	------	25, 26	2	17
Lovely Rodgers	------	Mrs. Nettie Hauck, Yosemite	------	11	3	17
		M				
Martinez	------	Mrs. E. J. Hannah, 909 E. Yosemite Ave., Madera	------	21	5	16
McCall, Bill Jones	------	No. 9 Gold Mining Co., c/o L. A. Ginana, Hornitos	28	10	5	16
McConley and M. W.	------	See Hite and M. S.				
Menlo	L	Henry J. Aden, Box 242, Vallejo	56	22,23,26,27	4	18
Merced Gold Mining Co.	------	A. S. Bigelow and G. M. Hyams of Boston	------	----------	3	16
Merced Placer (P), Stevenson (L), Daisy, Jubilee, Syndicate, Coolgardie	P	Percy L. Pettigrew, 1227 Flood Bldg., San Francisco (90 ac. placer, 75 lode)	165	36	3	16
Mocking Bird	------	C. J. and J. A. Schroeder, Mariposa	20	27	4	18

Morning Star	------	6/10 Jos. J. Trabucco, Mariposa, et al.	------	11, 12	4	16
Mountaineer No. 1	------	See New Year.				
Mt. King group of 18 patented claims	------	Mountain King Mining Co., 314 Kohl Bldg., San Francisco	348	31 6	3 4	18 18
		N		29, 30, 32	3	16
New Year, Wild Cat, Mountaineer No. 1	------	Angele Beaudry and Jos. F. Bouvier, 4 Laguna St., San Fnciscora	59			
North Barium	------	See East Baryte.				
North Pinon Blanco	------	See Pinon Blanco.		32	4	18
North Whitlock	------	W. J. Dusel, 340 Arlington rd., Redwood City	------			
		O				
Old Dominion	------	See Hite and M. S.				
Old Judge	------	See Pinon Blanco.				
		P				
Piedmont	------	See Virginia.				
Pinon Blanco, North Pinon Blanco, Old Judge, South Judge, Little Judge and M. S.	------	Oro Rico Mines Co., c/o A. E. Towers, Metropolitan Club, New York	95	19, 20, 29	2	16
Placer	------	W. D. Weston, Mariposa	20	33	4	18
Priest	------	See Hite and M. S.				
		Q				
Quartz Mine	------	John J. White, c/o C. White, 707 Florodora St., Fresno, et al.	22	10, 15	5	16
		R				
Rittershoffer (Tyro)	------	A. M. Easton, 225 Mills Bldg., San Francisco	------	9, 10	3	16
Roma and M. S.	------	M. A. and Frank H. Harris, 5th and Brannan Sts., San Francisco	25	14	4	18
Rothschild	------	See Goodview.				
Rutherford and M. S.	------	See Cranberry.				
		S				
S. A.		See Goodview.				
San Jose	------	See Goodview.				
Santa Clara	------	H. O. Davis (Mrs. M. L. Rooke), 3864 Platt Ave., Fresno	20	25	4	18
Schoolhouse	L	Mrs. Carmela Maschio	------	10	4	16
Schroeder	P	Judkins and Schroeder, Mariposa	20	16	4	18
Sierra Rica	------	Amelia Wilson and J. M. Graham, 256 N. 6th St., San Jose	10	14	4	18
Silver Right	------	See Sweetwater.				
South Barium	------	See East Baryte.				
South Judge	------	See Pinon Blanco.				
Southside	------	See Spring Tunnel.				
Southern Cross	------	See Sweetwater.				
Spencer	------	Ada I. Harris, c/o A. E. Dart, 1728 Broad St., San Luis Obispo	20	29	4	18

LIST OF PATENTED MINES WITH OWNERS' NAMES, FROM COUNTY ASSESSOR'S TAX LIST—Continued.

Name	Lode or placer	Owner	Acres	Location		
				Sec.	T.	R.
Spring Tunnel, Southside, Georgia Point and M. S.	------	Geo. Auch, et al.	45	26, 27, 34	3	19
Standard	------	A. J. Elftman, trustee, 2329 Parker St., Berkeley	------	33	4	18
Stevenson	L	See Merced Placer.				
Stonewall Jackson	------	See Goodview.				
Success Nugget	P	Ulysses S. Martin, 97 Webster St., San Francisco	20	25	2	17
Summit and M. S.	------	See Hite and M. S.				
Sunset	------	See Goodview.				
Sweetwater, Alta, Southern Cross, Silver Right	------	John Demartini, Bagby	74	19, 29, 30	3	17
Syndicate	------	See Merced Placer.				
		T				
Talc	------	Catherine Cuceo, Coulterville	20	19	3	17
Tandeur and M. S.	------	See La Victoria.				
Tyro	------	See Rittershoffer.				
		V				
Vanderbilt	------	See Diltz & Mann.				
Violet	------	G. S. Chambers, 416 E. Walnut St., Lodi	40	35	2	17
Virginia, Virginia No. 2, Piedmont, Claremont, August Belmont	------	Virginia Belmont Mining Co., Coulterville. Also Coe Gulch Placer	100	13, 14	3	16
		W				
Washington, Josephine, Jenny Lind	------	Mrs. Emeline Parker and Mariposa Land Co., 19 Bacon Bldg., Oakland	40	4, 5, 21	5	16
Westward	------	See Whitlock.				
Whitlock, Alabama, Westward	------	Gallison and Lain, 2821 Cherry St., Berkeley	45	32	4	18
Wild Cat	------	See New Year.				

LIST OF UNPATENTED MINING CLAIMS SHOWING TO WHOM ASSESSED, FROM COUNTY ASSESSOR'S ROLLS.

Year March, 1926, to March, 1927.

Name	Lode or placer	Owner	Location		
			Sec.	T.	R.
		A			
Agatha	P	Mrs. Elsie R. Devidio, Briceburg	10	4	14
Alder		See Grey Eagle.			
Alder Trail		See Occidental.			
Alice	L	John F. Feenan, Bagby	36	3	16
Amador, Copper King		Shareholders Legioneer Gold Mining Co. (defunct), c/o A. B. Smith, 629 Call Bdg., San Francisco	3	8	18
Amelia and Amelia Ext.	L	The Tennessee Mining Co., c/o H. Ward Dawson, 833 Market St., San Francisco	13	5	16
American		Hattie E. Obaw, Carlotta	1	3	16
Annayoung, El Portal No. 10 Ext.		Leo H. Heutner and W. Von Greifenstein, El Portal			
Antler		Cassius M. Joy, Security Trust and Savings Bank, Los Angeles		4	15
Argo		See Pioneer.			
Argonaut		See Sulphurets.			
Arkell group 11 claims and 3 mill sites		Charles Arkell, Jerseydale	2, 6, 27	3	19
Austin group of 7 claims		Mutual Mining Co., 1723 Webster St., Oakland	29, 30, 32	4	18
Avarite		See Mary Bess.			
		B			
Badger		See Robin.			
Bald Eagle		See Tomboy.			
Bald Eagle		See Sultana.			
Banner	L	Chas. S. Stewart, Coulterville		3	17
Barium Queen		Estate of Wm. Desario, c/o E. H. Baxter, 535 L St., Merced	18	3	20
Bell		See Buffalo Bill.			
Belle View		See Phoenix.			
Big Bonanza		Trujillo Mining Co., c/o F. W. McIntyre, 724 E. Broadway, Glendale		2	19
Big Bull Shoot Buck		See Reina De Los Mariposa.			
Big Oak, Del Monte, Thelmas, Sandy Bar		J. H. Towers, Mariposa	7	4	20
			13	3	19
Billings, Buckeye		O. S. Evans, Hornitos	30	3	16
Bishop Creek		Jesse C. Werly, Mist			

LIST OF UNPATENTED MINING CLAIMS SHOWING TO WHOM ASSESSED, FROM COUNTY ASSESSOR'S ROLLS—Continued.

Year March, 1926, to March, 1927.

Name	Lode or placer	Owner	Location		
			Sec.	T.	R.
Black, Confidence (P), Confidence No. 2, Confidence Placer	------	John L. Green, et al., 1673 Railway Exchange Bldg., St. Louis, Mo.	1, 12	4	19
Black Eagle	------	Dan Demartini, Bagby.			
Black Jack	------	R. B. Dexter, Coulterville	1	3	16
Black Oak	------	M. Kane, Usona	8	5	20
Black Sam, Yellow Pine	------	Frank Musante, Coulterville	11	3	16
Blue Bird	------	See Lakeside.			
Blue Gravel	------	See Gold Center.			
Blue Jay	------	See Odin.			
Blue Jay	L	Jack Gammon, Coulterville	----------	3	16
Bob and Lank	------	See Elsie M.			
Bonanza	------	See Shallaly.			
Bondurant East Ext., Bondurant West Ext.	------	See Garfield.			
Bonita	------	See Optimo.			
Boulder	P	Andrew J. Bitcon, Mariposa	20	4	18
Boulder, Permit	------	Theo E. Kockel, Mariposa	23 31	4 4	18 18
Brown Bear Group	------	Daniel Heaton, Jerseydale	7	4	20
Buck Shot	P	Albert Affolter, Mariposa	----------	4	18
Buckeye	------	See Billings.			
Buffalo Bill, Florence, Dorothy, Bell, Margarita, Thelma	------	California Gold Mines Co., c/o W. A. Grantham, Hollywood Athletic Club, Hollywood	----------	2	18
Burna Creek	L	Y. R. Trabucco, Hornitos	34	4	16
Buro	------	F. H. Cathaywood, Jerseydale	----------	4	20
Buzzard	------	See New Discovery.			
		C			
Cabin	P	Harold Brinham, 3817 Telegraph Ave., Oakland	23	3	19
Calderon	------	Arthur, Jas. and Geo. Bauers, Hornitos	7	5	16
Caldwell, Nelly Bly, Independence	------	Judkins and Schroeder, Mariposa	16	4	18
Cannon Gulch	------	See Cleveland.			
Carmencita	------	See Optimo.			
Castagnetto	L	Mrs. Mary Castagnetto, 1223 E. Lindsay St., Stockton	26	2	16

Chance		See Shallaly.			
Charles, Patricia		C. C. Schlageter, Mariposa	19	4	17
Checkmate		See Shallaly.			
Cherry Tree		See Recorder.			
Chimesal	L	Harry Barrett, Merced Falls			
Chucaloda, Riverview, Evelyn		E. W. Grant, Hornitos			
Cincinnati, Ohio	L	A. W. Francisco, c/o C. M. Jay, 718 Washington Bldg., Los Angeles		2	17
Colorado	P	John J. Wildt, Jerseydale	27	4	18
Colorado group of 3 claims		Chas. H. Weston, 433 9th St., Richmond, and P. W. Jenkins, 1015 Nevin Ave., Richmond, et al.	27	4	18
Cleveland, Cleveland Ext., Cannon Gulch, Harry C.		Harry Taylor, Mariposa	28	4	18
Columbia		See Sulphurets.			
Commercial		See Iron Duke.			
Confidence		See Black.			
Copper King		See Amador.			
Coyote Hall		Agnes M. Bradford, c/o L. M. Bradford, Raymond	11	6	18
Croesus, Crown Prince		Croesus Mining Co., c/o M. D. Allen, 1735 N. Wilcox, Hollywood	6	4	17
Crystall		See Penobscott.			
		D			
Darby		Mrs. Emma McDiarmid, Coulterville			
Dartmouth		M. S. Fraser and M. E. McLean, Coulterville			
Deer Flat group of 6 claims		J. E. Trujillo, Coulterville		2	19
Del Monte		See Big Oak.			
Democrat		See Sulphurets.			
Desario group of 4 claims		Mrs. Helen Desario, 1744 Berkeley Ave., Stockton	34	3	19
Diana Mines No. 1, 2, 3, 4, 5, 6, 7, 8		California Gold Mines, Inc., c/o Mrs. E. M. Coplen, 1535 N. Hobart St., Los Angeles	30, 31	2	18
Diehl group of 4 claims		A. W. Diehl, Coulterville	11	3	17
Doctor, Two Brothers, Yosemite Gold, Seventy-seven Minerals, Golden Reward		Jas. L. Diven, 147 Kempton Ave., Oakland	2	5	19
Dolly Grey		W. A. Smith, 930 E. San Fernando St., San Jose			
Domingo	L	Geo. Barrett, Coulterville			
Donald Mac		See Tomboy.			
Dorothy		Mrs. Melani J. Artru, c/o Mr. Camin, Mariposa	27	4	18
Dorothy		See Buffalo Bill.			
Douglas		See Iron Duke.			
Dreadnaught		See New Discovery.			
		E			
Eagle Peak		See Marie.			
El Capitan group of 14 claims		El Capitan Gold Mining Co. of Nevada, c/o James H. Eaton, Union League Club, San Francisco	22	3	19

LIST OF UNPATENTED MINING CLAIMS SHOWING TO WHOM ASSESSED, FROM COUNTY ASSESSOR'S ROLLS—Continued.

Year March, 1926, to March, 1927.

Name	Lode or placer	Owner	Location		
			Sec.	T.	R.
Elizabeth		See Stepping Stones.			
El Portal, El Capitan	L	F. E. Bass and John Yeager, 2801 Union St., San Francisco	22	3	19
El Portal No. 10 Ext.		See Annayoung.			
El Rio No. 1		Hal Fredricks, El Portal		3	20
Elsie M, Bob and Lauk	P	B. Hoyle, Wawona	34	4	21
Eureka		F. M. Skelton, Lewis			
Eureka, Oro Fino		J. C. Donelly, Jerseydale		4	19
Evelyn		See Chucaloda.			
Evening Star, Evening Star N. W. Ext.		Louis Trabucco, Mt. Bullion	11	4	16
Excelsior		See Monte Cristo.			
Exchange, Great Giant	L	L. E. Tryon, Modesto			
Exposition		A. L. Soule, Sonora	23	3	16
		F			
Father		See Prince.			
Fanny Bell	P	E. T. Brooks, 830 Gage St., Los Angeles			
Farber group of 3 claims		United Building and Development Co., Golden Gate Theatre Bldg., San Francisco	24	4	18
Feliciana Ext. No. 1, 2, 3 and 4		Morris Farber, 445 Waller St., San Francisco			
Florence		See Buffalo Bill.			
Fools Choice		See Stepping Stones.			
Forest Haven		E. I. Ingram, c/o M. S. Fraser, Coulterville			
Franklin, McKinley	L	Fred Blum, Mt. Bullion	19	4	18
Fraser and Frank group of 8 claims		Estelle T. Fraser and Geo. Frank, Coulterville		3	18
Fremont Trail, Quartz King	L	C. M. Joy, 718 Washington Bldg., Los Angeles			
		G			
Garfield		L. O. Wilson, et al., Coulterville	10	3	18
Garfield, Review, Bondurant, West Ext., Bondurant, East Ext., Tunnel		Walter F. Ritz, Box 1648, Modesto		2	18
Ginaco No. 1 and 2		L. A. Ginaca, Hornitos	10	5	16
Ginaco No. 3		C. A. Darby			

Gloryn		J. L. Tiscornia et al., 524 Columbus Ave., San Francisco	25	3	16
Gold Central (L), Blue Gravel (P), Knob Hill		A. H. Hagan, Coulterville	6	3	17
Gold King group of 6 claims		Gold King Mining Co., Box 1648, Modesto	19, 32	2	18
Gold Road		See Shallaly.			
Gold Run, Red Hill		F. P. Sanchez, Hornitos		4	16
Golden Eagle	L	J. A. Brown, Capitola	27	4	16
Golden Gate		W. J. and Lulu M. Patterson, 1843 9th Ave., San Francisco	7	3	18
Golden Reward		See Prince.			
Golden Reward		See Doctor.			
Good Luck (L), Good Luck	P	John L. McLean, Coulterville	25	4	17
Good Luck, Horseshoe		Eva Clark and Minnie Myers, Mariposa	25	4	18
Great Giant		See Exchange.			
Grey Eagle (L), Melba, Alder		James Gazzola, Coulterville, and Grey Eagle Mining Co., 1319 N. Main St., Los Angeles	30	3	17
		H			
Happy Home		W. J. Patterson, 1843 9th Ave., San Francisco	7	3	18
Hard Luck	L	H. I. Shilling, Coulterville	24	3	17
Hard Luck, Pyrophylite		Wm. E. Finch, Box 18, Sonora	30	3	17
Harry C.		See Cleveland.			
Heinholt	P	Robert Russell, Mariposa	20	4	18
Hidden Treasure, Sixteen to One		G. W. Garrett, Bagby	31	3	17
Hidden View group of 6 claims		I. J. Blocher, 828 Myrtle St., Oakland	35	3	17
Hite Cove group of 3 claims		L. M. and E. R. Johnson, 356 W. 60th St., Los Angeles			
Home		C. J. and J. A. Schroeder, Mariposa	16	4	18
Horseshoe		See Good Luck.			
Horseshoe group of 14 claims		Clara Bibbero and David A. Green, c/o D. H. Green, 2524 Mission St., San Francisco		3	16
Hove Lode	L	Chas. A. Hove, 3246 Million St., Pasadena			
		I			
Independence		See Caldwell.			
Independence, Starlight		E. M. True, Bagby	30	4	16
Inspiration		See Platinum King.			
Iowa, New York		Herbert H. and Chas. H. Carlton, Suite 1004, 111 W. Monroe St., Chicago, Ill.	29	4	29
Iron Duke, Douglas (L), Commercial		Jack Kojovich, Hunters Valley, Hornitos	4	4	16
		J			
Johnnie F.		See Ohio Placer.			
Josie, Key Lode, Key Lode Ext.		Chas. A. Darby, c/o B. S. McArthur, 1237 23d Ave., Oakland	10	5	16
Juliette, Buena Vista		California Copper Producers Trust et al., c/o E. J. Preston, 629 Call Bldg., San Francisco	3	8	18
Jumper	L	Chas. H. Burt, Mt. Bullion	25	4	16
June		A. W. Azebedo, Coulterville		3	17

LIST OF UNPATENTED MINING CLAIMS SHOWING TO WHOM ASSESSED, FROM COUNTY ASSESSOR'S ROLLS—Continued.

Year March, 1926, to March, 1927.

Name	Lode or placer	Owner	Location		
			Sec.	T.	R.
		K			
Key Lode		See Josie.			
Keystone		Francis L. Shirran, Yuba City			
Keystone		See Optimo.			
King Saxon, Queen Saxon		Fred Mebold, Mariposa	21	4	18
King Midas		See Rainbows End.			
Knob Hill		See Gold Center.			
		L			
Lafayette		June Queirola, Hornitos		4	16
Lakeside, Blue Bird		O. R. Williams et al., Box 223, Oakland			
La Mariposa		See Sunset.			
Landrum, Tozier		Sim Landrum, R.F.D. 1, box 16, Merced	34	4	18
Last Chance		P. R. Peterson, Coulterville			
Lena		Mrs. R. O'Brien, Millbrae		4	15
Little Wonder group of 46 claims		T. A. Clark, 412 DeYoung Bldg., San Francisco	6, 7, 8, 9	4	20
Live Oak		Mervin McElligott, Mariposa	10	6	18
Lone Star		See Optimo.			
Las Palomas		See Mariposa		4	16
Lost Forlorn		Yellow Metals Mining Co., 40th and Hollis St., Emeryville	17	4	18
Lucky (L), Surprise		Joe F. Cardoza, Cathay		4	16
Lucky Fourteen group of 4 claims		Lucky Fourteen Mining Co., c/o E. E. Ryan, Secy., 5525 Vallejo St., Emeryville	16	4	19
Lucky Spot		Joe Martin, Bagby	14	4	17
		M			
Manzanita		A. R. Jeffrey and Jack Pendray, Coulterville		3	17
Margaret		See Buffalo Bill.			
Marie, Eagle Peak		E. E. Robertson, Jerseydale		4	19
Mariposa, Las Palomas		N. Sanchez, Hornitos		4	16
Mary Bess, Avarite		W. P. Hofstetter, R.F.D. A, box 214, Los Gatos	29	4	18
McKinley		See Franklin.			

Meadow, Old Home		E. F. Fraser and M. E. McLean, Coulterville		3	18
Milburn	L	Mrs. Lucy J. Milburn, Mariposa	31	4	18
Mildred	P	W. M. Frew, Jerseydale	30	3	19
Milo		Wm. E. Props	6	3	17
Mistery, Squaw Flat		Chas. A. Strandt, Coulterville		3	17
Mohawk, Mohawk No. 2, Tuxedo		D. G. Kidder, Coulterville		3	16
Monte Cristo, Excelsior		F. M. Skelton, Jerseydale	20	4	19
Mt. Gains group of 15 claims		Mt. Gains Mining and Milling Co., c/o Glenn C. Williams, R.F.D. 1, box 291, Bellflower	35	4	16
Mt. Queen		Est. of Geo. Shimer, c/o C. V. Ellis, Yosemite			
Mt. Queen, Sunset		Chas. E. Paine, Mariposa	29	4	18
		N			
Nelly Bly		See Caldwell.			
Nevills group of 5 claims		Nevills Mining Co., c/o J. J. Nevills, 465 California St., San Francisco	23	3	17
New Discovery, Buzzard, Dreadnaught, Star King		Robert B. Kennedy, 74 3d St., San Francisco		2	19
New York		See Iowa.			
Night Hawk		See Stepping Stones.			
North Star, Oro Grande		Nick Mullins and Max Jones, Mariposa			
Nugget, Yellow Kid		J. E. Duprey et al., Madera			
Number Five, Number Five Ext		Milton Sutherland, Hornitos	11	5	16
		O			
Occidental, Superb No. 1 and No. 2, Alder Trail No. 1 and No. 2, Saddle Gas No. 1 and No. 2		Thornton Jackson	34 2	4 5	21 21
Odell group of 7 claims		George Odell, Bagby	14	4	17
Odin, Blue Jay		Geo. Lydiksen, 1616 25th Ave., Oakland	36	3	17
Ohio		See Cincinnati.			
Ohio Placer (P), Johnnie F.		Mrs. Jennie E. Diven, 147 Kempton Ave., Oakland	29	4	18
Old Home		See Meadow.			
Old Keok		Lizzie J. Bothger and Lester V. Dunlap, 823 E. Anderson St., Stockton			
Old Timbers Club		Foresta Hodgson, Jerseydale	15	4	19
Oochum	P	Guy E. Quick, Ben Hur			
Optimo, Keystone (L), Carmencita, Bonita, Lone Star		J. C. McTanahan, Hotel Spokane, 248½ E. 5th St., Los Angeles			
Oro Fino		See Eureka.			
Oro Grande		See North Star.			
Our Chance	L	L. F. Austin, Mt. Bullion	29	4	18
Oversight		See Shallaly.			
		P			
Patricia	L	Annie P. Brinham, Big Oak Flat	35	3	19
Patricia		See Charles.			
Penobscott, Crystall		D. J. Stollery, Trustee, c/o A. H. Elftman, 704 De Young Bldg., San Francisco	35	4	18

LIST OF UNPATENTED MINING CLAIMS SHOWING TO WHOM ASSESSED, FROM COUNTY ASSESSOR'S ROLLS—Continued.

Year March, 1926, to March, 1927.

Name	Lode or placer	Owner	Location		
			Sec.	T.	R.
Permit		See Boulder.			
Phoenix, Belle View		C. F. Lewis, Mariposa	20	4	18
Piedmont No. 1		R. H. Brotherton, 564 Market St., San Francisco			
Pine Lodge		W. W. Ferguson, Turlock			
Pioneer, Argo		Walter D. McLean, Coulterville	16	2	17
Pioneer, Talk		L. F. W. Busch, Mariposa	28	4	18
Platinum King, Platinum Queen, Inspiration		C. F. Kingery, Merced	31	3	17
Prince, Rose Gold, Golden Reward, Father		J. S. Wallace, 718 Washington Bldg., Los Angeles			
Princess		James Tresidder, 908 55th st., Oakland	32	4	18
Pyrophylite		See Hard Luck.			
		Q			
Quartz King		See Fremont Trail			
Queen Saxon		See King Saxon			
		R			
Rainbows End, King Midas		Pearl I. Werly, Mist		4	20
Raven		See Tomboy.			
Recorder, Rex, Cherry Tree		Robert McLean, Mariposa	20	4	18
Red Bank	P	Wm. Arthur and Dareid Oneto, Hornitos	20	5	16
Red Garnett, Red Garnett South Ext.		Louis Hanson, Clearinghouse	21	3	19
Red Hill		See Gold Run			
Regina Oaks		J. R. Feliz, c/o F. Ruiz, Mariposa	31	4	19
Reina De Los Mariposas, Big Bull Shoot, Buck, Snapp		John D. Moore, Bagby	32	3	18
Reking	P	Ludwig Rosenheimer, Bagby	14	4	17
Review		See Garfield.			
Rex		See Recorder.			
Riverview		See Chucaloda.			
Roamer		Louis Milani, Coulterville		3	16
Robbin	L	L. R. Johnson et al., Box 882, Merced			
Robin, Badger, Unnamed		Francis A. Cavagnaro, Hornitos	9	4	16
Rose Gold		See Prince.			
		S			
Saddle Gap		See Occidental.			
San Domingo Annex		W. S. Zeller, 949 Excelsior Ave., Oakland	13	4	18
Sandy Bar		See Big Oak			

Scandinavian		O. Carlson, Buck Meadows		2	17
Sebastopol	L	L. L. Hart, Mariposa	32	5	19
Seventy Seven Minerals		See Doctor.			
Shallaly, Bonanza (L), Gold Road, Chance, Oversight, Checkmate		Mrs. Annie A. Scanlon, 601 41st Ave., San Francisco	7	3	18
Sharlee		See Washington.			
Shippery group of 8 claims		A. R. & A. B. Shippery & E. F. Lothrop, 830 State Life Bldg., Indianapolis, Indiana	3, 4	6	19
Silver Lead		Wm. McNally, Mariposa		6	19
Simeon Landrum		Harry I. Maddox, Box 402, Merced	34	4	18
Sixteen to One		See Hidden Treasure.			
Snapp		See Reina De Las Mariposas.			
South Cranberry, South Cranberry Ext.		Helen Bass, 2801 Union St., San Francisco	22	3	19
Spangler		Mrs. M. F. Spear and McIver, Box 128, Merced Falls	2	5	15
Spread Eagle group of 6 claims		Nick Mullins, Mariposa	32	4	18
Squaw Flat		See Mistery.			
Star (L), Stephen	P	Oro Rico Mines Co., c/o A. E. Towers, Metropolitan Club, New York	20	2	16
Star King		See New Discovery.			
Starlight		See Independence.			
Stepping Stones, Night Hawk, Fools Choice, Elizabeth		Jackson Lawrence, Mariposa	30	5	19
St. Gabriel		A. J. Sanchez et al., 430 15th St., Merced			
St. Gabriel		A. T. Alarid et al., 319 Heller St., Redwood City	5	5	16
St. Paul		J. C. Straub, Madera	33	5	19
Stud Horse Flat group, 5 claims		J. P. Carrolll, Bagby	35	3	16
Sulphurets, Argonaut (L), Democrat, Spring, Columbia		Quartzburg Mining Co., 615 Washington Ave., Point Richmond	32	4	16
Sultana, Bald Eagle		Bains and Tresidder, Mariposa	32	4	18
Sultana Ext.		W. T. Rhodes, Clearinghouse			
Summit		See Union.			
Sunset		John L. Dexter et al., Mariposa		2	17
Sunset, Venus, La Mariposa		Thos. Trujillo, Hornitos	24	4	16
Sunset		See Mt. Queen.			
Superb		See Occidental.			
Surprise		See Lucky.			
Sweetwater Mine 10 claims	L	C. A. McCartney, Jerseydale	17, 20	4	19
		T			
Talc, Talc Extension		Herbert Shaw, Sonora	32	3	17
Talk		See Pioneer.			
Telegraph Mt. No. 1 to No. 5		F. B. House, 383 Ocean View Ave., Santa Cruz	13	4	17
Thelma		See Buffalo Bill.			
Thelmas		See Big Oak.			
Tom and Mary		Irene Marrche and Chas. E. Sites, Modesto			
Tomboy, Bald Eagle, Raven, Donald Mac		Thos. Rogers and Mrs. A. A. Peterson, c/o Thos. Rogers, Mariposa	30	5	19
Tozier		See Landrum.			
Triumph		Est. of Jos. Helm, c/o J. M. Helm, Le Grand	29	4	18

LIST OF UNPATENTED MINING CLAIMS SHOWING TO WHOM ASSESSED, FROM COUNTY ASSESSOR'S ROLLS—Continued.

Year March, 1926, to March, 1927.

Name	Lode or placer	Owner	Location		
			Sec.	T.	R.
Tunnel		See Garfield.			
Tuxedo		See Mohawk.			
Two Brothers		See Doctor.			
		U			
Uncle Jim Mine, 8 claims		Wm. H. Rykert, 778 Ruthupham Ave., Ross Hill Station, Los Angeles	20, 29	3	19
Union, Summit		T. J. Ferguson, Jerseydale		4	19
Union Leader group		W. W. Hilliard, Coulterville	30	2	19
Unnamed		See Robin.			
Upper Willow No. 2	P	Malissa Clayton, R.F.D. 1, box 209, Selma	19	4	18
		V			
Venus		See Sunset.			
		W			
Washington, Sharlee		Washington Mines Syndicate Co., c/o Frank Bosserman, 6422 Fountain Ave., Hollywood, or Leon J. Bogy, 2625 Ocean Front, Ocean Park	28	4	18
Washington		See Yosemite Railroad.			
Water Lily		Harry L. Frisbie et al., 1461 Stannage Ave., Berkeley			
West Ruthford (L), West Ruthford Ext.		F. E. Bass, 2801 Union St., San Francisco	22	3	19
White Oak	L	A. B. Smith and W. J. Scofield, 55 5th St., San Francisco	18	3	19
White Rock		Angels Gabarina, Coulterville			
Willow	P	J. W. Myers and Malisse Clayton, R.F.D. 1, box 209, Selma	20	4	18
Winner		Mrs. Elsie R. Devidio, Mariposa	21, 28	4	18
		Y			
Yellow Jacket		Eugene Lutz, Hornitos	25	4	16
Yellow Kid		See Nugget.			
Yellow Metal group		Yellow Metal Mining Co., 40th and Hollis Sts., Emeryville	17	4	18
Yellow Pine		See Black Sam.			
Yosemite Gold		See Doctor.			
Yosemite Railroad (P), Washington		Thos. M. Julian et al., c/o D. B., 1546 Fruitvale Ave., Oakland	5	4	17

LIST OF UNPATENTED MINING CLAIMS AND NAME OF OWNER, FROM COUNTY ASSESSOR'S RECORDS, MARCH 1 TO OCTOBER 1, 1927

Name	Owner	Location		
		Sec.	T.	R.
	A			
Albany Lode, Liberty Lode	Wm. H. Rykert and Anna Bingham, 778 Ruthupham Ave., Ross Hill Station, Los Angeles	29	3	19
Alena Belle, Blue Quartz, Luckie Lindie, Grain Gold, Mable	Belle McCord Roberts, Long Beach			
Alice L. Quartz, Good Luck G. Quartz, Hard Luck B. Quartz, Sunset F. Placer	Edward M. Roller	36	3	17
Alma Quartz	G. C. Brammer	21	3	19
	B			
Banner Group	Geo. K. Allen, 328 Olive Ave., Piedmont	30, 31	4	18
Belle View Ext.	John A. Schroeder, Mariposa	32	4	18
Berkeley	Alvin C. Wingand			
Bertram Farber	See Pauline Farber.			
Bessie I.	Wm. H. Foster, Bagby			
Big Bill	W. L. Clairborne, P. A. Garage, 20th and Bush Sts., San Francisco	30, 31	4	18
Billings	O. B. Evans, Hornitos	30	3	16
Black Jack	D. W. Strickland, Jerseydale; E. E. Case et al.			
Blue Quartz	See Alena Belle.			
Bonanza	John McCann, Mariposa		4	18
Bonanza	See Bull Dog.			
Bonanza Quartz	John McCann and Lee Lemaster, Mariposa	28	4	18
Bridge Placer	Mrs. J. P. Hearn, Bagby	6	4	17
Bright Hope	R. W. Davis, Mt. Bullion	25	4	16
Bull Dog, Bonanza Bug, Mammoth, Bonanza, Jumper, Sunset, Columbia, Eureka	Frank J. Bruschi, Coulterville		3	16
Bull Frog Quartz	See Mexican Quartz.			
Burnite	J. M. Rowland, Cathay		6	18
	C			
Carmel Placer	George G. Gage, El Portal			
Carrie K.	See Sunrise Placer.			
Challenge, Pine Crest, Pine Crest Ext.	W. P. Gallic, Hornitos	30	3	16
Chesterfield Quartz	Geo. Walker, Mariposa			
Columbia	See Bull Dog.			
Copper King	See Kemper Quartz.			

LIST OF UNPATENTED MINING CLAIMS AND NAME OF OWNER, FROM COUNTY ASSESSOR'S RECORDS, MARCH 1 TO OCTOBER 1, 1927—Continued.

Name	Owner	Location		
		Sec.	T.	R.
	D			
Dixie Quartz	G. L. Oldham and R. McLean, Mariposa	27	4	18
Dooley Placer	Chas. Schindler, Bagby			
	E			
Ethel May Quartz	Jas. Vincent Lloyd, Bagby	11	4	17
Eureka	See Bull Dog.			
Eureka No. 2	L. C. Johnson		3	20
	F			
February E.	See Sunrise Placer.			
	G			
Good Luck G.	See Alice L. Quartz.			
Gopher C. Quartz, Rattlesnake N.	Ernest Chrestenson, El Portal			
Grain Gold	See Alena Belle.			
Grand View	Silvan J. Press, Bagby	36	3	16
	H			
Hard Luck B.	See Alice L. Quartz.			
Hazel Quartz	W. B. Mahoney, 122 10th St., Modesto			
Hope So, Sebastopol Ext.	H. Harrison, J. B. Annear and A. G. Lane, Mariposa			
Hudson Lode	W. H. Rykert and Ellen Elmer, 778 Ruthupham Ave., Ross Hill Station, Los Angeles	20	3	19
	J			
Johnnie Green, Jr.	C. A. Robinson, Merced		8	18
Jumper	See Bull Dog.			
	K			
Kemper Quartz, Copper King	R. T. Kemper, Bagby	14	4	17
	L			
Lafayette Quartz, Lafayette Ext.	C. A. Quierolo, Hornitos	5, 6	4	16
Last Chance	Mattie Brown, Coulterville		3	17
Lena Farber	See Pauline Farber.			
Liberty Lode	See Albany Lode.			
Lizzie No. 1, 2 and 3	Peter B. Johan		3	19

Lone Peak	Glenn A. Wallerstedt, Indian Peak or Mist			
Lone Pine	J. M. Elam and Nick Mullins, Mariposa		4	18
Lone Pine Quartz	J. M. Elam, Mariposa			
Lucky Judd Quartz	C. H. Harlan, Kinsley or Coulterville		3	18
Luckie Lindie	See Alena Belle.			
	M			
Make No Mistake	See Sunnyside Quartz.			
Mammoth	See Bull Dog.			
Marble	See Alena Belle.			
Margarita James Quartz	Alan and Robt. Stout, Box 983, Merced	12	5	19
Marshall Quartz	M. L. Black, Hornitos		4	16
Mexican Quartz, Bull Frog Quartz	Lee M. Sanchez, Hornitos	17, 18	4	16
Midway Quartz	See Sunnyside Quartz.			
Mistake Placer	G. D. Winder	26	3	16
Mistletoe, Niggertoe	Milo J. Caton, 549 23d st., Merced			
Morning Sun	Frank A. Howath and John R. Rolland, Coulterville	6	3	17
Mt. Climb	Sam M. Bogdonovich, Mist			
	N			
Niggertoe	See Mistletoe.			
Nightingale Quartz	Cora B. Johnson, Modesto			
Nola Placer	B. H. Boone, Clearinghouse	24	3	19
Nugget Placer	Edna H. Peterson, Hornitos			
	O			
Oak Flat Placer	Harry Barrett and Albert Cline, Hornitos			
Oat Hill and Oat Hill Ext. Placer	Wm. Erler, Merced Falls			
Olney Ext.	Eldridge D. Barrett, Coulterville		4	16
	P			
Pauline Farber, Lena Farber, Bertram Farber, Sunset Lode	United Building and Development Co., Golden Gate Theater Bldg., San Francisco			
Pearl	Grace Coleman, Incline	13	3	19
Pershing, Specimen	Eli J. Maria et al., Coulterville			
Pine Crest	See Challenge.			
Placer	E. T. Autrand and Geo. E. Trumble, Bagby			
	R			
Rattlesnake N.	See Gopher C. Quartz.			
Red Jasper Placer	David R. Griffith, Merced	19	3	16
Riverside Quartz	See Sunnyside Quartz.			
	S			
Sebastopol Ext.	See Hope So.			
Shake Cabin	Nicholas Albardd, Mt. Buck	24	4	19
Shamrock Placer	Geo. McDaniel, Mariposa		5	16

LIST OF UNPATENTED MINING CLAIMS AND NAME OF OWNER, FROM COUNTY ASSESSOR'S RECORDS, MARCH 1 TO OCTOBER 1, 1927—Continued.

Name	Owner	Location		
		Sec.	T.	R.
Silano No. 1 and 2, Victor Quartz	Jean Poussou, Mariposa		4	18
Silver Bar No. 2, 3, 4	Susan McNally, Mariposa	9	6	16
Specimen	See Gopher C. Quartz.			
Sunnyside Quartz, Midway Quartz, Riverside Quartz, Make No Mistake, Siempre-Viva Placer	J. C. Krohn, c/o Chas. Arkell, Mariposa		3	19
Siempre-Viva Placer	See Sunnyside Quartz.			
Sunrise Placer, Carrie K. Quartz, February E. Quartz	Mrs. Alice Chrestenson, El Portal		3	20
Sunset	See Bull Dog.			
Sunset F. Placer	See Alice L. Quartz.			
Sunset Lode	See Pauline Farber.			
	T			
Tar Lode	Thos. L. Fay, Merced Falls			
Three Oaks	J. N. Brothers, 122 10th St., Modesto			
Troy Lode	Wm. H. Rykert and Geo. E. Howe, 778 Ruthupham Ave., Ross Hill Station, Los Angeles	20	3	19
	U			
Una Placer, Unab Quartz	Ross W. Cobb, Clearinghouse		3	20
Unac Quartz, Unaf Quartz	C. C. McVey, Bagby			
Unnamed	Fred T. Smith, Mariposa			
Unnamed	Margarite Allen, Mariposa			
	V			
Victor Quartz	See Silano.			
	W			
W. and H. Quartz	John Wildy and M. T. Hennessy, Jerseydale	12	4	17
Water Lily	Harry Kanner and H. L. Frisbie, Coulterville		3	18
White Iron group of 13 claims	Paul A. Schultz, Bagby			
White Oak	Belle McCord Roberts, Long Beach			

Development consists of a 230-ft. shaft with two levels. On the 100-ft. level there are drifts 160′ east and 65′ west; on the 200-ft. level drifts 60′ east and 60′ west.

The old mill contained a 6-foot Marathon mill, 5-foot Huntington mill and two concentrating tables, all driven by a 40-h.p. Union gas engine. Former operators failed to save the values in the ore with this equipment and most of the production to date has come from selected high-grade ore which was shipped. Water is scarce except in winter. The present operators propose to put in a flotation system which it is believed will solve the metallurgical problem and make it possible to recover all of the values in the form of bullion at the mine. Part of the old equipment will be used in construction of the new treatment plant.

There is a parallel vein, about one-half mile south of the Silver Bar Mine, which has been developed on the *Wallman Ranch Property* to a depth of 280 feet by shaft. The 190-ft. level is drifted east for 92 feet. The ore here is similar to that of the Silver Bar, carrying a little gold associated with argentite, ruby silver and other antimonial and arsenical silver sulphides. It is probable that this ore will be milled at the Silver Bar plant when in operation if the proposed treatment proves successful in recovering the values.

Wallman Ranch Property. (See Silver Bar Mine.)

ZINC

A deposit of triboluminescent zinc blende mixed with barite and gray tetrahedrite, the ore resembling a dark gray schist, is found in Secs. 9 and 10, T. 4 S., R. 15 E. The sphalerite (blende) emits a peculiar streak of light when scratched or rubbed in the dark with a knife or piece of steel. Some quartz possesses this same property of emitting light.

The Asposozien Company, care of F. V. Keesling, 1205 De Young Building, San Francisco, owns 80 acres of land covering the deposit. The material was at one time ground and sold under the name of 'Akoz' as a remedy for various ailments on the assumption that it contained radium.

It is stated that the ore carries 40% zinc. It has been idle for the past 10 or 15 years.

NONMETALLICS

The first commercial production of a nonmetallic mineral in Mariposa County was in 1899, when 110 squares of slate were marketed. Miscellaneous stone, barytes, marble, jasper and limestone have since been added to the commercial list. In 1926 the value of the nonmetallics, not including limestone, amounted to 42 per cent of the value of all minerals produced. The limestone quarry of the Yosemite Portland Cement Company was placed on an operating basis in 1927 and it is probable that beginning in 1927 the output of nonmetallics will exceed the metals in value, unless there is a sharp increase in metal mining.

Mariposa County contains deposits of many nonmetallic minerals, but it should be remembered that the marketing of most of these minerals is on an intensely competitive basis. They must compete in

quality and prices with the same products, imported and domestic, and also with substitutes, as for instance, asbestos shingles versus wood, and gypsum board versus celotex, a vegetable product. It will be seen that the mine owner has to meet well-organized competition and a thorough investigation should be made not only as to the deposits themselves, but also of market standardization requirements, beneficiation necessary, freight rates and other factors, before large expenditures are made in attempting to exploit these minerals, or losses will result.

ASBESTOS

Amphibole asbestos has been found in the serpentine areas along the Mother Lode at a number of places and small veins of chrysotile also occur in serpentine near Mariposa. None of these deposits have been developed, and their commercial value is problematical. E. L. Camin of Mariposa is reported to have a deposit near Mariposa.

BARITE

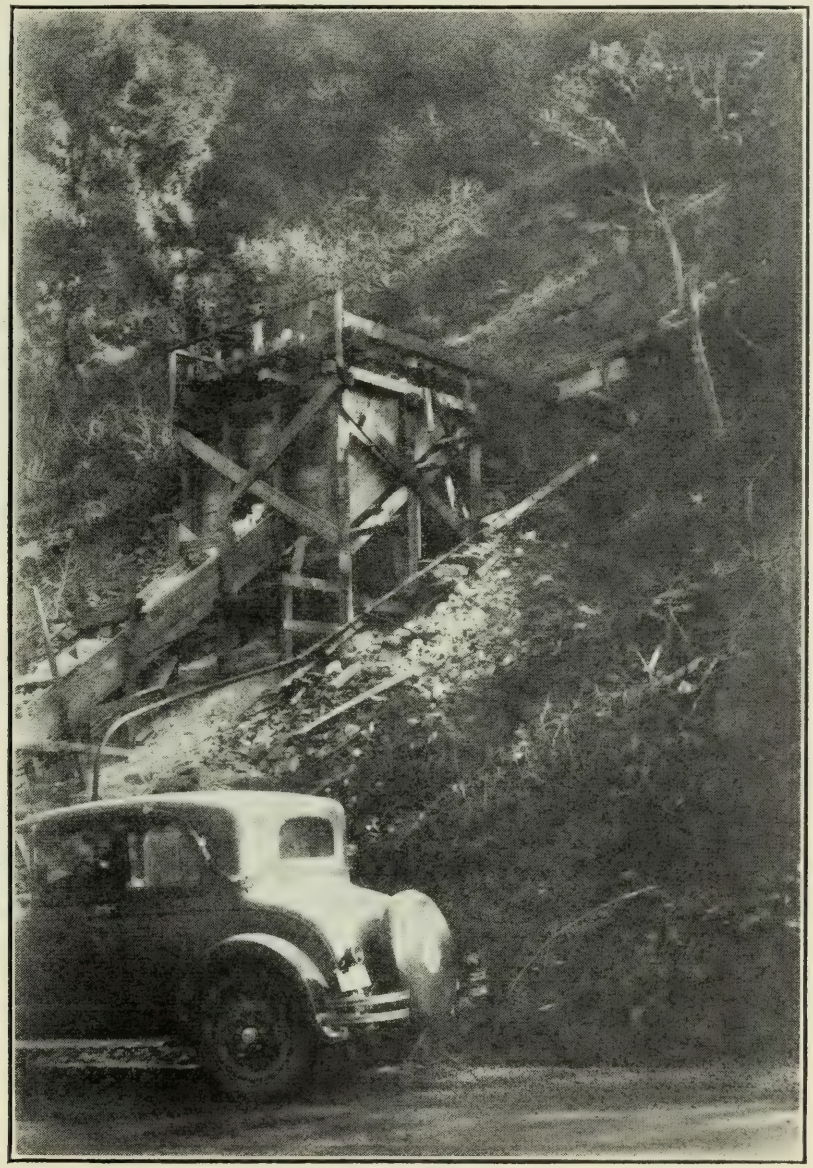
Egenhoff Barite Deposit. This deposit, which was discovered in 1917, is situated in Sec. 17, T. 4 S., R. 20 E., about five miles by trail from Jerseydale and six miles in an airline south of Yosemite Valley Railroad at its nearest point. Owner, W. D. Egenhoff, 85 Second street, San Francisco.

There are three claims with a total area of 60 acres. They lie at an elevation of 5000 feet and the surrounding country is mountainous. Water is obtained from springs and scattered timber covers the claims. The barite is fine-grained and white. It occurs in ledge form, with a slight dip to the east and strike a little west of north, between a hanging wall of limestone and footwall of quartzite. During 1927 a camp was constructed, the ledge traced for 4500 feet or more in length and prospected by several crosscuts, but so far its size has not been fully determined. Transportation would probably have to be provided by aerial tram to the railroad or by a branch rail line up the South Fork of Merced River, should the deposit warrant it.

Yosemite Barium Company. This company, a close organization in course of incorporation, with R. A. Fredericks as manager, is operating the barite deposit near El Portal, formerly worked at different periods by *El Portal Mining Co.* and *Western Rock Products Co.*, of San Francisco. Home office, Box 97, Merced; mine address, El Portal.

The deposit is located on Merced River one mile west of El Portal in Secs. 18 and 19, T. 3 S., R. 20 E. The river canyon cuts directly across the barite lode, and Yosemite Valley Railroad and the new Yosemite highway likewise cross the deposit. Elevation at the workings is 2000 feet, but the canyon sides rise steeply on the north and south to much higher elevations. Barite was discovered here on the north side of the river in the 80's, and former mining activities were on that side. In March, 1927, development of the deposit south of the river was begun and the present output is now coming from these new workings. The barite is mined by drifting and stoping. There are two adits run on the vein, the face of the upper one being 80 feet below the surface. This level is being stoped. The second adit is 180 feet below the upper. The workings show the lode to be irregular, the

vein swelling into a series of lenses, one large one now opened up being estimated to contain several hundred thousand tons of barite. The average width of the main vein is 14 feet, and the maximum width so far developed, 35 feet. There is also a smaller parallel vein from which some production has been made. The company controls 500 acres of land on which the deposit occurs. The barite is shipped crude, as mined, the present output being about 75 tons per day, the crude



Loading bunker at Yosemite Barium Company's Mine, near El Portal, Mariposa County.

material averaging 94% $BaSO_4$. Some witherite ($BaCO_3$) is associated with the barite in places, but it is not being mined.

Equipment at the property includes a 50-h.p. Diesel engine, compressor, air drills, track, cars, etc. A cable way is being constructed to transport the material across the river to bunkers on the railroad. The barite is loaded from a chute to auto trucks and hauled to El Portal for shipment while this is being completed. Sixteen men are employed.

FELDSPAR

Feldspar occurs as a constituent of the granites and other rocks in Yosemite Valley and it has been noted near Coulterville, but the first reported discovery of what is apparently a commercial deposit of potash feldspar has just been made (December, 1927). This discovery became known subsequent to the present survey and the deposit has not as yet been visited by a representative of the Division of Mines and Mining.

Hamilton Feldspar Deposit. This deposit is on the old Joseph Carmichael ranch in Sec. 30, T. 5 S., R. 17 E., now owned by Matthew Hamilton, c/o Stockton Record, Stockton, California, and other members of the Hamilton family. It is located seven miles easterly from Hornitos, or 15 miles from Yosemite Valley Railroad at Merced Falls. The elevation is 1350 feet; surface, rolling hills. Bear Creek and Corbett Creek flow through the property, which comprises 485 acres of patented land. The holdings have been used as a cattle range and there is no equipment. There are three known ledges and several massive deposits reported. One ledge is stated to have been traced for nearly a mile, apparently following a large bull quartz vein. According to the owner, the outcrop varies from a few feet to over 300 feet in width, as well as containing several blowouts, indicating quarry possibilities. As yet, no development work has been done. A sample from the outcrop submitted to the laboratory proved to be orthoclase (potash) feldspar, with a small amount of iron oxide present.

GARNET

A well-defined dike of garnet-bearing rock has been traced for several miles striking in a north-south direction across the southeastern end of Guadalupe Mountains. It outcrops plainly about two miles from Bridgeport where the dike crosses China Creek. In places on the property of Wm. Wass (P. O. address, Cathay), in Secs. 21 and 22, T. 6 S., R. 18 E., the dike rock is thickly studded with garnets of the grossularite variety, ranging in diameter from $\frac{1}{4}$ to $\frac{3}{4}$ inch. No garnets of gem value were seen, but they could no doubt be utilized in the manufacture of garnet paper and cloth, or as garnet sand for abrasive purposes.

Massive brown almandite garnet also occurs on Mt. Hoffman, but the location of this deposit within Yosemite National Park precludes its being worked.

GRANITE

The granite resources of Mariposa County are unlimited in extent and of practically all textures; much of it no doubt equal to that being quarried at Raymond, Madera County. The National Park Service has utilized considerable of the granite and grano-diorite in Yosemite Valley in local construction work and road building, operating a quarry and crushing plant as occasion requires.

At the base of Big Spring Hill, in Sec. 30, T. 5 S., R. 19 E., three miles east of Mariposa and adjacent to the Mariposa-Bootjack road, there is a ledge of white aplite 30 to 40 feet wide, which would make an excellent building stone. Aplite is a white micaless granite. Apparently a little of this rock was quarried years ago.

JASPER ROCK

Jasper Rock Quarries. (Formerly Merced Stone Quarries.) This property consists of 60 acres of patented land, situated on the north side of Merced River on Yosemite Valley Railroad, at Jasper station in Sec. 19, T. 3 S., R. 16 E. Elevation, 800 feet. A crushing plant was at one time operated here by E. B. and A. L. Stone Co. of San Francisco, and the rock sold as ordinary ballast. In 1927 the quarry was acquired by H. J. Kelm of Bagby, who recognized the value of the rock for special use in the building industry in the manufacture of composition roofing and shingles, and as surfacing granules. He reopened the quarry under the name of Jasper Rock Quarries, and is now producing variously colored jasper rock for special uses at the rate of 40 tons per day. Address, Jasper Rock Quarries, H. J. Kelm, owner, Bagby, California.

The deposit consists of highly silicified sedimentary formations. They dip about 45° W. and have been opened up across the face for 900 feet. In the eastern end of the quarry the jasper is green in color, but toward the western end, red, brown, purple, green and variegated colors occur. Strata heavily impregnated with manganese occur in the footwall and some chimneys of manganese are found. At present the output is shipped as quarry run, all crushing being done at the manufacturing plants. The quarry is worked by open cut, the face standing 120 to 150 feet in height. Equipment includes one 20-h.p. and one 7-h.p. gas engine for operating, compressor and hoist; air drills, 1000 feet of track, mine cars and boarding house. Ten men are employed.

H. P. Varain of La Grange has submitted a sample of red jasper said to have come from a large ledge on the north side of Merced River, one mile from Yosemite Valley Railroad line, Mariposa County.

LIMESTONE AND MARBLE

Large deposits of limestone and marble are among the important mineral resources of this county. Their existence has been known for many years, but there was little or no commercial output until 1927. The principal occurrences are: near Exchequer dam on the east side of Lake McClure in Sec. 18, T. 4 S., R. 16 E.; in the limestone belt which extends in a southeasterly direction through Bower Cave, 12 miles east of Coulterville to Jenkins Hill on Merced River, where it is now being quarried on a large scale; and at Marble Point near Hites Cave on the South Fork Merced River.

The latter deposit is in Sec. 2, T. 4 S., R. 19 E., and is owned by F. A. Bondshu, J. F. Harris, C. P. Pratt and J. W. Pratt of Mariposa. This material is a fine variegated marble, white with dark blue streaks through it, and takes a high polish. The deposit is approximately 3000 feet in width here and stands 600 feet above the river, but its location is not easily accessible.

Limestone occurs also at El Portal, and in T. 4 S., R. 20 E., five miles east of Jerseydale, in the same belt in which barite is found.

Yosemite Portland Cement Corporation (Emory Quarry). This company, which began the manufacture of portland cement at their plant in Merced in 1927, owns and operates a very large high-grade limestone quarry, known as Emory Quarry, in Mariposa County. A.

Emory Wishon, president; Murray Bourne, secretary; home office, Merced; Burt Hannigan, quarry superintendent, Emory Station.

The quarry property is located at Jenkins Hill on the north side of Merced River, 11 miles below El Portal in Secs. 7 and 8, T. 3 S., R. 19 E., and contains 700 acres. Yosemite Valley Railroad, which crosses the property, provides direct rail transportation to the Merced plant. Elevation at the railroad, 1340 feet.

The limestone outcrops prominently and has no overburden. It trends north and dips about 85° E. The rock is somewhat dark in color due to the presence of 1½% of carbonaceous matter, but this is eliminated in burning and does not affect the whiteness of the finished cement.

During 1927 operations progressed from the development stage to an operating status, regular shipments of limestone beginning in September. A working face has been opened up 800 feet above the railroad level. At present the face is 30 feet high and 375 feet long. It will eventually extend the whole length of the deposit. From this floor the face can still be carried 500 feet higher. In mining, jackhammer drills are used, both lifter and top holes being put in. After blasting, the broken rock is loaded with a Marion No. 32 electric shovel into 6-yard standard-gauge dump cars. These are hauled in trains by a Plymouth 14-ton gasoline locomotive 2000 feet to the crushing plant at the head of the incline tramway. The primary crusher is an Allis-Chalmers No. 15 gyratory. This is followed by a Williams Jumbo hammer-mill, which reduces the rock to a maximum of 1½-inch size. The crushed rock is then delivered by conveyor belt to a 600-ton storage bin. This upper bin is connected with the lower bunker at the railroad by a double track, balanced, incline tramway. There are two cars of 15-ton capacity, the loaded car pulling up the empty, with regenerative braking and automatic dumping arrangement at the lower bunkers. The latter hold 275 tons and discharge direct to railroad cars.

The quarry is electrically operated throughout the connected load being 850 horsepower, which is supplied by the San Joaquin Light and Power Company's lines. Good living quarters are provided and the boarding house is electrically equipped for cooking and refrigeration. Thirty-five men compose the regular quarry crew.

Bibl: Rock Products, June 11, 1927.

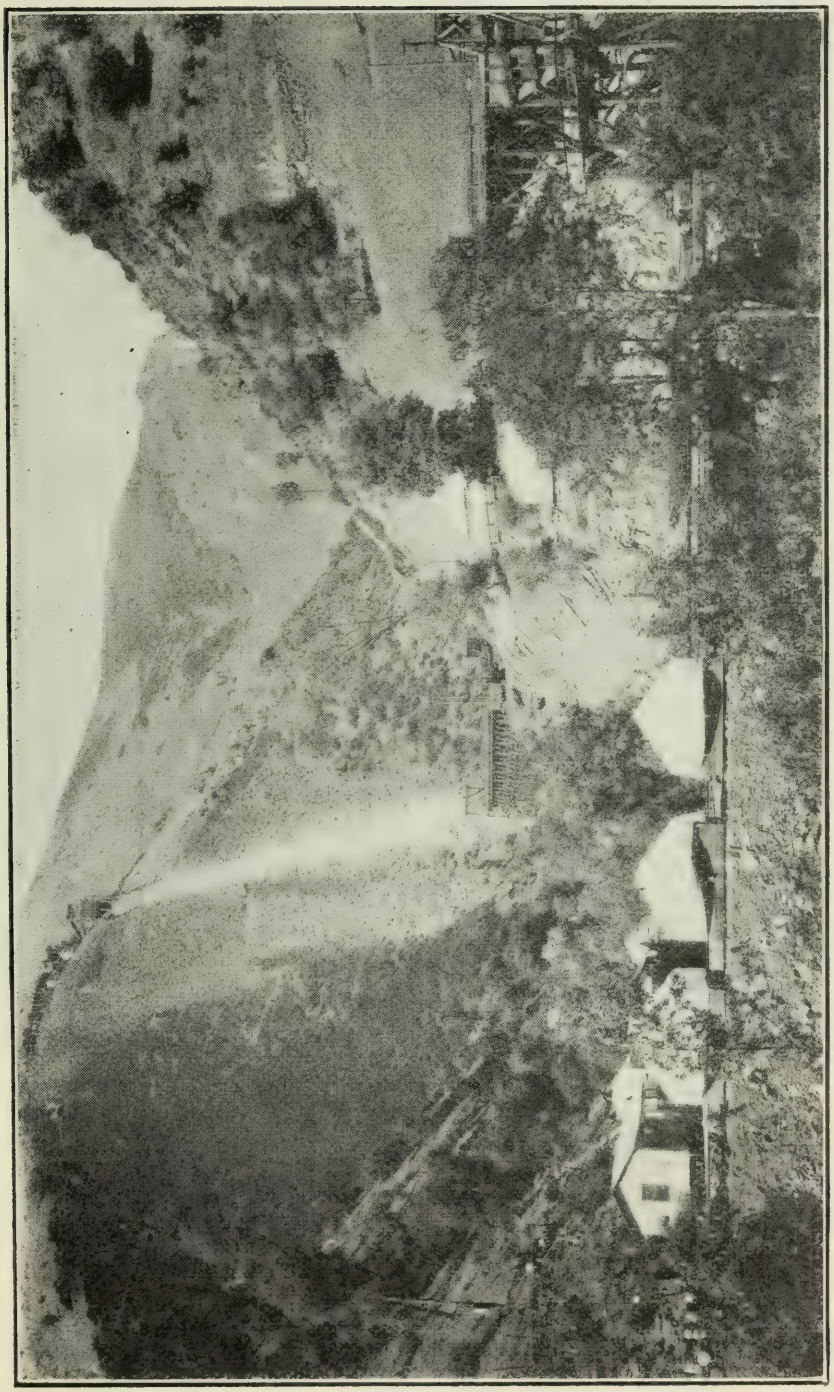
MAGNESITE

Several small veins of magnesite, up to two feet wide on the surface, outcrop on Big Spring Hill in Sec. 30, T. 5 S., R. 19 E., about three miles east of Mariposa. They have only been dug into a few feet. Considerable float is found in the vicinity. They are on the ranch of Erwin J. Ashworth of Mariposa.

Adjacent to the magnesite deposit in Sec. 30, T. 5 S., R. 19 E., there is a vein of soft white, compact amorphous silica, that was erroneously referred to in previous reports as meerschaum. It appears to be a spring deposit and is small in extent. It is on the Erwin J. Ashworth ranch.

MARIPOSITE

Beautiful mottled green and white Mariposite occurs at several localities along the Mother Lode in the county, notably near Coulterville. There is a possible market for limited quantities of this material for stucco 'dash' and as an ornamental stone.



Crushing plant, upper bunkers, tramway to lower bunkers and quarry face (at lowest point in skyline); Emory Quarry, Yosemite Portland Cement Corporation, Mariposa County. Photo by R. L. Mook, during early stage of operation.

MICA-SCHIST

Mica-schist, talc-schist, amphibolite-schist, pyrophylite and similar magnesium aluminum silicates are found at various points in the county as rock-forming minerals in the broad zone of Jurassic and Cretaceous rocks lying between the valley sediments and the granite batholith of the Sierra. Certain commercial uses have been developed in recent years for some of these schistose and talcose minerals and research work is continually adding to the number that may have a special industrial use. A large undeveloped deposit of pyrophylite occurs at Three Buttes, about two miles southwest of Indian Gulch, in Sec. 9, T. 6 S., R. 16 E., that may eventually prove valuable.

ROCK CRYSTAL

Quartz crystals in considerable amount, some of good quality, but mostly of small size, have been found in many of the mines in Mariposa County. There has been no commercial output, although there is a market for rock crystal that meets certain specifications regarding size,



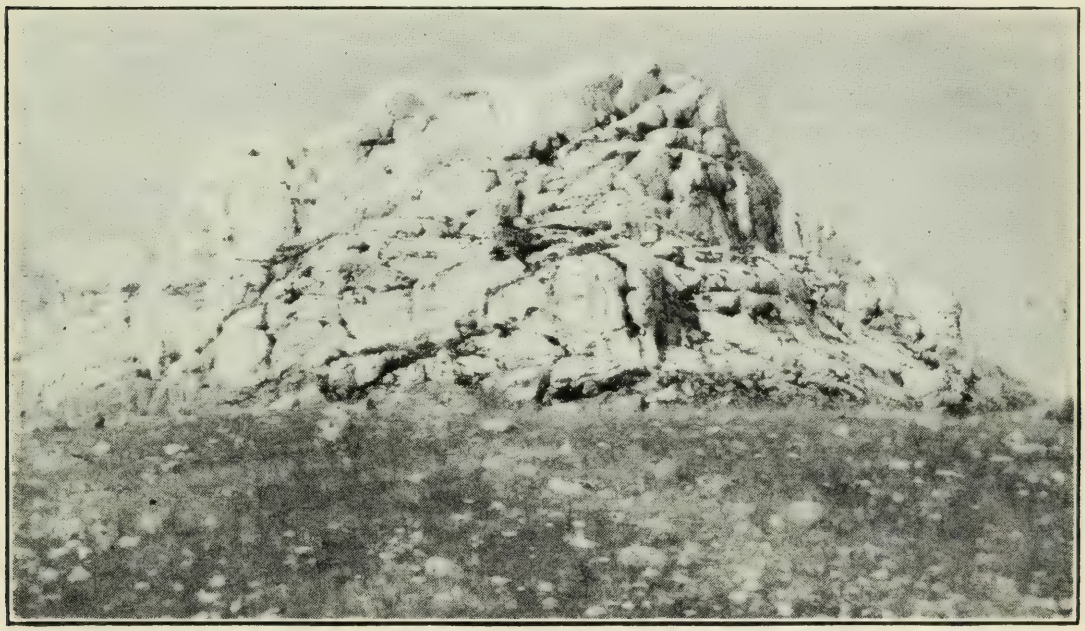
White Rock Silica (quartz) Deposit, near Lewis, Mariposa County.

clearness and freedom from flaws, for industrial uses and as a gem material. W. L. Apperson, Mariposa, has taken out several tons from his property.

SILICA

White Rock Silica Deposit is on patented land, owned by J. H. Helm and P. Carmean of Le Grand. The deposit consists of a massive outcrop of white glassy quartz, practically pure silica, but with occasional spots showing a little iron stain. The outcrop is on the top of a knoll at an elevation of 1117 feet and is a noted landmark for miles around, being visible from the valley highway. This massive vein occurs near the contact of slate on the west and a granite instrusion of almost circular form. One mile southeast of this exposure there is another similar outcrop, apparently on the same vein but somewhat smaller,

and several parallel veins of bull quartz, outcropping at intervals, are visible from White Rock deposit. Two carloads of silica were shipped to Los Angeles in 1926, but at the prevailing price it was found unprofitable. The cost of mining, 14-mile haul to the railroad at Le Grand and freight to Los Angeles left no surplus; but a slight reduction in transportation costs would permit operation. The amount of silica in sight has been variously estimated at one to three million tons. The old White Rock copper mine is only a few hundred yards distant.



Close-up view of White Rock Silica Deposit; a massive outcrop of practically pure quartz visible for miles, Mariposa County.

SLATE

Slate and schistose rocks are very abundant in the western half of the county, the Mariposa slates of the gold belt being one of the most prominent formations. Many of the old buildings now in ruins were constructed of these fissile rocks which were easily split and laid up in walls. Yosemite Valley Highway crosses the slate belt soon after leaving the valley floor. This belt extends along the southwestern side of the county its entire length. Several slate quarries have been opened up in the past, but there has been no production for about 20 years except a small tonnage from one of the dumps, which was shipped out in 1926 and crushed for roofing rock.

Cunningham Slate Quarry consists of slate land in Secs. 6, 7, 8 and 17, T. 7 S., R. 17 E., owned by Cunningham Corporation, Planada. This quarry was under lease for a period of 15 years and a considerable quantity of good roofing slate was produced when it was operated. Idle.

Pacific Slate Quarry comprises 50 acres situated in Sec. 6, T. 6 S., R. 16 E., four miles from Merced Falls; owned by Pacific Slate Company, Merced. Most of the slate produced here in the past was used for roofing purposes. Idle.

A good outcrop of slate is exposed on the south side of Merced River opposite and a little west of Bagby. Numerous outcrops occur on the ranch of Chase and Son, adjacent to Yosemite Valley Highway in T. 7 S., R. 16 E. It is also found on the Robert Prouty holdings in T. 4 S., R. 15 E., on the Muller Ranch near Hornitos and at many other points, but the quality that can be produced will remain undetermined until some development has been done.

SOAPSTONE AND TALC

Fairly extensive deposits of soapstone and talc occur along the Mother Lode. A large deposit of soapstone about 12 miles east of Coulterville was utilized in the early days, one of the large corner buildings in the town being constructed of sawed blocks of this stone. It has been used locally in fireplace construction.

Cuceo Talc Claim consists of one patented claim of 20 acres, situated in Sec. 19, T. 3 S., R. 17 E., in the Flyaway district.

Shaw Talc Claims. Herbert Shaw of Sonora has two claims, the Talc and Talc Extension, situated in Sec. 32, T. 3 S., R. 17 E., in the Flyaway district.

Yosemite Talc Mine comprises one claim at the lower end of Flyaway Gulch in Sec. 31, T. 3 S., R. 17 E., 1½ miles from Bagby; owner, T. B. Elliott, Box 1993, Angels Camp. This deposit is 75 feet wide and has been developed by open cuts and a 60-ft. shaft. The talc is white in color and contains no lime. An analysis gave the following results:

	Per cent
SiO_2	61.0
Fe and Al_2	2.5
MgO	32.55
H_2O	2.3
Undetermined	1.65
	100.00

Samples of foliated talc have been submitted by Charles E. Hill of Ben Hur or Usona. Henry Fick of Mariposa also has submitted talc samples. Talc has been noted as occurring on the property of Robert Prouty in Sec. 11, T. 4 S., R 15 E., and there are numerous other unrecorded occurrences. Their commercial possibilities remain to be determined.

STONE (MISCELLANEOUS)

There are no commercial crushed rock, sand and gravel plants operating in the county. The National Park Service has a quarry, crushing and screening plant in Yosemite Valley, which is operated as occasion demands to supply crushed rock for road and other construction work carried on by the government.

During 1927 the State Highway Commission let a contract for the crushing of the Mariposa Mine dump near Mariposa and 38,000 tons of crushed rock was produced here for highway use.

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OIL FIELD DEVELOPMENT OPERATIONS

By R. D. Bush, State Oil and Gas Supervisor.

From January 1, 1928, to and including March 31, 1928, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
ALAMEDA COUNTY:					
R. Y. Hanlon	3	5	1	1	
FRESNO COUNTY:					
Standard Oil Co.	11	19	15	208	Coalinga
Zier Oil Co.	1	20	14	27	Coalinga
KERN COUNTY:					
Berry Oil Co.	30	28	21	25	Belridge
Berry Oil Co.	30	28	21	29	Belridge
Berry Oil Co.	30	28	21	44	Belridge
Associated Oil Co.	23	28	27	2	Kern River
Associated Oil Co.	23	28	27	3	Kern River
Associated Oil Co.	23	28	27	4	Kern River
Associated Oil Co.	23	28	27	6	Kern River
Associated Oil Co.	23	28	27	44	Kern River
Associated Oil Co.	23	28	27	53	Kern River
Associated Oil Co.	23	28	27	54	Kern River
Bishop Corp.	23	28	27	6	Kern River
Brownmoor Oil Co.	16	28	27	Cauley 2	Kern River
Brownmoor Oil Co.	16	28	27	Cauley 12-A	Kern River
California Petroleum Corp.	26	28	27	Cole 2	Kern River
California Petroleum Corp.	23	28	27	Lehmann 5	Kern River
California Star Oil Co.	22	28	27	1-80	Kern River
California Star Oil Co.	22	28	27	3-40	Kern River
California Star Oil Co.	22	28	27	4-80	Kern River
Chanslor-Canfield Midway Oil Co.	23	28	27	15	Kern River
Chanslor-Canfield Midway Oil Co.	23	28	27	16	Kern River
Chanslor-Canfield Midway Oil Co.	23	28	27	17	Kern River
Chanslor-Canfield Midway Oil Co.	23	28	27	18	Kern River
Chanslor-Canfield Midway Oil Co.	23	28	27	19	Kern River
Chanslor-Canfield Midway Oil Co.	23	28	27	20	Kern River
Chanslor-Canfield Midway Oil Co.	23	28	27	21	Kern River
General Petroleum Corp.	14	28	27	19	Kern River
General Petroleum Corp.	26	28	27	Sill 5	Kern River
General Petroleum Corp.	26	28	27	Sill 6	Kern River
General Petroleum Corp.	26	28	27	Sill 31	Kern River
General Petroleum Corp.	26	28	27	Sill 32	Kern River
General Petroleum Corp.	14	28	27	Wetmore 12	Kern River
George F. Getty, Inc.	26	28	27	Grady 6	Kern River
George F. Getty, Inc.	26	28	27	McDougall 3	Kern River
George F. Getty, Inc.	26	28	27	McDougall 4	Kern River
George F. Getty, Inc.	26	28	27	McDougall 5	Kern River
George F. Getty, Inc.	26	28	27	McDougall 6	Kern River
George F. Getty, Inc.	26	28	27	McDougall 7	Kern River
The Kern River Oilfields of Cal., Ltd.	26	28	27	5	Kern River
The Kern River Oilfields of Cal., Ltd.	26	28	27	9	Kern River
Midland Oilfields Co., Ltd.	14	28	27	1	Kern River
Midland Oilfields Co., Ltd.	14	28	27	2	Kern River
Midland Oilfields Co., Ltd.	14	28	27	3	Kern River
Midland Oilfields Co., Ltd.	14	28	27	6	Kern River
Midland Oilfields Co., Ltd.	14	28	27	9	Kern River
Midland Oilfields Co., Ltd.	14	28	27	12	Kern River
Midland Oilfields Co., Ltd.	14	28	27	13	Kern River
Midland Oilfields Co., Ltd.	14	28	27	14	Kern River
Midland Oilfields Co., Ltd.	14	28	27	15	Kern River
Petroleum Securities Co.	22	28	27	10	Kern River
Petroleum Securities Co.	22	28	27	11	Kern River
Petroleum Securities Co.	22	28	27	12	Kern River
Petroleum Securities Co.	22	28	27	13	Kern River
Petroleum Securities Co.	22	28	27	14	Kern River

OIL FIELD DEVELOPMENT OPERATIONS—Continued

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued.					
Petroleum Securities Co.	22	28	27	15	Kern River
Standard Oil Co.	27	27	27	14	Kern River
Standard Oil Co.	15	28	27	21	Kern River
H. H. Bell	4	30	22	3	McKittrick
Franco-Western Oil Co.	8	30	22	9	McKittrick
Keefe-Morrison, Inc.	8	30	22	8	McKittrick
C. C. M. O. Co.	7	32	23	4	Midway
C. R. Craft	21	31	22	5	Midway
Honolulu Consolidated Oil Co.	6	32	24	79	Midway
Midland Oilfields Co., Ltd.	34	31	24	Thornber 2-A	Midway
North American Oil Consolidated	32	31	24	3-A	Midway
North American Oil Consolidated	32	31	24	7	Midway
North American Oil Consolidated	16	32	23	26	Midway
North American Oil Consolidated	32	31	24	29	Midway
Republic Petroleum Co.	7	32	23	31	Midway
Standard Oil Co.	3	32	24	45	Midway
Standard Oil Co.	29	31	24	52	Midway
Standard Oil Co.	19	31	24	84	Midway
Standard Oil Co.	19	31	24	85	Midway
Standard Oil Co.	29	31	24	85	Midway
Standard Oil Co.	33	31	24	92	Midway
Standard Oil Co.	33	31	24	99	Midway
Western Production Co.	21	31	22	12	Midway
Berry Oil Co.	25	27	28	Glide 1	Mt. Poso
California Petroleum Corp.	15	27	28	1	Mt. Poso
General Petroleum Corp.	21	27	28	Glide 21 . 7	Mt. Poso
General Petroleum Corp.	21	27	28	Glide 21 . 9	Mt. Poso
Modoc Petroleum Corp.	32	26	28	Kathryn Hyde 2	Mt. Poso
Shell Co.	1	27	27	Glide 3	Mt. Poso
Signal Gasoline Co., Inc.	27	27	28	1	Mt. Poso
Elbe Oil Land Development Co.	20	28	29	11	Round Mountain
Elbe Oil Land Development Co.	20	28	29	13	Round Mountain
Elbe Oil Land Development Co.	20	28	29	94	Round Mountain
Shell Co.	29	28	29	Jewett 2	Round Mountain
Henry Robinett	2	29	20	1	Temblor
Standard Oil Co.	27	11	20	Kern Co. Lease No. 2 33	Wheeler Ridge
Doheny Stone Drill Co.	21	26	22	Kerwin 1	----------
R. B. Jackson & C. H. Chamberlan	19	29	28	1	----------
Milham Exploration Co.	8	28	23	Kern 3	----------
Milhan Exploration Co.	5	28	23	Kern 4	----------
North American Oil Cons.	5	25	26	Wallace 1-A	----------
J. E. O'Donnell	31	30	28	Houghton 1	----------
The Pacific Eastern Production Co.	6	30	28	K. C. L. 2	----------
The Pacific Eastern Production Co.	21	29	27	2-KCL-B	----------
The Pacific Eastern Production Co.	21	29	27	3-KCL-B	----------
Shell Co.	16	26	28	Corral Canyon 1	----------
Southern California Gas Co.	4	28	23	4-1	----------
W. W. Stabler	23	32	29	1	----------
Superior Oil Co.	24	29	29	Bloemer 1	----------
Zurich Oil Co.	30	28	22	1	----------
LOS ANGELES COUNTY:					
Union Oil Co.	33	3	13	Callender 22	Dominguez
Union Oil Co.	33	3	13	Callender 23	Dominguez
Union Oil Co.	33	3	13	Carson 4	Dominguez
Standard Oil Co.	8	2	14	Baldwin-Cienega 38	Inglewood
Standard Oil Co.	8	2	14	Baldwin-Cienega 47	Inglewood
Standard Oil Co.	17	2	14	L. A. Inv. 1 55	Inglewood
Bartholomae Oil Corp.	29	4	12	5	Long Beach
Bolsa Chica Oil Corp.	30	4	12	Mutual 5	Long Beach
Bush-Voorhis Oil Co.	20	4	12	23	Long Beach
California Petroleum Corp.	30	4	12	Croswell 2	Long Beach
California Petroleum Corp.	19	4	12	Davidson 9	Long Beach
California Petroleum Corp.	19	4	12	Foster Two 4	Long Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
California Petroleum Corp.	20	4	12	Gray 3	Long Beach
J. H. Cochran	29	4	12	1	Long Beach
Dabney-Johnston Oil Corp.	30	4	12	7	Long Beach
Dabney-Johnston Oil Corp.	24	4	13	8	Long Beach
Dabney-Johnston Oil Corp.	29	4	12	9	Long Beach
Dabney-Johnston Oil Corp.	24	4	13	10	Long Beach
Delaney Petroleum Corp.	29	4	12	Community 1	Long Beach
L. T. Edwards	29	4	12	Long & Paulson 1	Long Beach
L. T. Edwards	29	4	12	Mickelson 1	Long Beach
Fred Fitch	29	4	12	Sievers 1	Long Beach
General Petroleum Corp.	19	4	12	K. & H. 9	Long Beach
George F. Getty, Inc.	29	4	12	L. B. 25	Long Beach
George F. Getty, Inc.	20	4	12	L. B. 27	Long Beach
George F. Getty, Inc. and J. Paul Getty	19	4	12	L. B. 23-A	Long Beach
George F. Getty, Inc. and J. Paul Getty	19	4	12	L. B. 26	Long Beach
Graham-Loftus Oil Co.	19	4	12	Acme 1	Long Beach
Graham-Loftus Oil Co.	19	4	12	Acme 2	Long Beach
Graham-Loftus Oil Co.	19	4	12	Acme 3	Long Beach
Greek-American Petroleum Corp.	29	4	12	1	Long Beach
Greek-American Petroleum Corp.	29	4	12	2	Long Beach
Hancock Oil Co.	19	4	12	Signal 7	Long Beach
Herndon Petroleum Corp.	29	4	12	Herndon 6	Long Beach
Herndon Petroleum Corp.	29	4	12	Herndon 7	Long Beach
Ideal Oil Co.	19	4	12	1	Long Beach
Thomas Kelly & Sons, Inc.	19	4	12	Kelly 2	Long Beach
Marine Corp.	29	4	12	61	Long Beach
Marine Corp.	19	4	12	62	Long Beach
Marine Corp.—Cal-Mex Oil & Refining Co.	19	4	12	26	Long Beach
Edwin T. Mattox	28	4	12	Mattox 1	Long Beach
McKeon Drilling Co., Inc.	28	4	12	Community 1	Long Beach
McKeon Drilling Co., Inc.	29	4	12	Conklin 1	Long Beach
McKeon Drilling Co., Inc.	29	4	12	Deeds 1	Long Beach
McKeon Drilling Co., Inc.	19	4	12	Knight 1	Long Beach
Miley Oil Co.	29	4	12	Miley-Signal 1	Long Beach
Miley Oil Co.	19	4	12	Miley-Signal 2	Long Beach
J. E. O'Donnell	29	4	12	O'Donnell 66	Long Beach
Painted Hills Oil Ass'n.	19	4	12	14	Long Beach
Pan American Petroleum Co.	29	4	12	Drake 1	Long Beach
Pan American Petroleum Co.	29	4	12	Pyle-Coffin 2	Long Beach
The Petroleum Co.	19	4	12	Rissman 3	Long Beach
Petroleum Exploration Co.	29	4	12	Prudential 1	Long Beach
Max Pray	19	4	12	1	Long Beach
Richfield Oil Co.	19	4	12	Augustine 2	Long Beach
Richfield Oil Co.	29	4	12	Booth 10	Long Beach
Richfield Oil Co.	29	4	12	Denni 7	Long Beach
Richfield Oil Co.	29	4	12	Fry 4	Long Beach
Richfield Oil Co.	19	4	12	Hoover 3	Long Beach
Richfield Oil Co.	29	4	12	Lekas 3	Long Beach
Richfield Oil Co.	19	4	12	Malcom-Davis 3	Long Beach
Richfield Oil Co.	19	4	12	R. C. 8	Long Beach
Richfield Oil Co.	20	4	12	Roco 1	Long Beach
Richfield Oil Co.	20	4	12	Scoco 1	Long Beach
Shell Co.	20	4	12	Andrews 6	Long Beach
Shell Co.	29	4	12	Binkley 4	Long Beach
Shell Co.	29	4	12	Brown 1	Long Beach
Shell Co.	29	4	12	Cherry Hill Comm. 6	Long Beach
Shell Co.	29	4	12	Church Comm. 2	Long Beach
Shell Co.	29	4	12	Coseboom 8	Long Beach
Shell Co.	29	4	12	Dobyns 5	Long Beach
Shell Co.	29	4	12	Foster Comm. 2	Long Beach
Shell Co.	29	4	12	Hamilton 3	Long Beach
Shell Co.	29	4	12	Horsch 3	Long Beach
Shell Co.	29	4	12	Jones Comm. 7	Long Beach
Shell Co.	29	4	12	Jones Comm. 8	Long Beach
Shell Co.	20	4	12	Marcellus 5	Long Beach
Shell Co.	29	4	12	Nicholson 5	Long Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
Shell Co.	29	4	12	Pala 2	Long Beach
Shell Co.	29	4	12	Patton-Wilson 6	Long Beach
Shell Co.	29	4	12	Patton-Wilson 7	Long Beach
Shell Co.	29	4	12	Pickler 7	Long Beach
Shell Co.	29	4	12	Pickler 8	Long Beach
Shell Co.	29	4	12	Wells 3	Long Beach
Shell Co.	29	4	12	Wells 4	Long Beach
Shell Co.	29	4	12	Wilbur 4	Long Beach
Signal Syndicate No. 4	30	4	12	8	Long Beach
South Basin Oil Co.	30	4	12	Nakamura 2	Long Beach
Travis Drilling Co.	19	4	12	Travis 3	Long Beach
Union Oil Co.	19	4	12	U. S. Royalties 1	Long Beach
Warren & Macrate	19	4	12	Neet 2	Long Beach
Wilshire Oil Co., Inc.	20	4	12	Wilshire Long Beach 1	Long Baech
Woolner Oil Corp.	19	4	12	Signal Hill 3	Long Beach
World Petroleum Corp.	33	4	12	Signal Hill 9	Long Beach
Associated Oil Co.	34	2	14	Cypress 2	Potrero
Petroleum Securities Co.	27	2	14	Connolly 1	Potrero
W. R. Preston	17	3	13	1	Rosecrans
A. D. Kneuper	10	5	12	1	Seal Beach
Standard Oil Co.	3	5	12	San Gabriel 18	Seal Beach
C. C. M. O. Co.	15	4	14	Torrance 81	Torrance
Easton & Smith et al.	19	1	17	3	----------
D. H. Wood	5	7	10	1	----------
MONTEREY COUNTY:					
Marland Oil Co.	32	24	11	Nacimiento 1	----------
ORANGE COUNTY:					
Birch Oil Co.	2	3	10	15	Brea Olinda
Fullerton Oil Co.	2	3	10	23	Brea Olinda
California Petroleum Corp.	28	5	11	Buck 5	Huntington Beach
P. Campbell	10	6	11	1	Huntington Beach
Geo. E. Cloud	10	6	11	2	Huntington Beach
Globe Lease & Royalty Co.	27	5	11	4	Huntington Beach
Imperial Gypsum & Oil Corp.	34	5	11	2	Huntington Beach
John Morris	10	6	11	2	Huntington Beach
Paul & Collier	10	6	11	2	Huntington Beach
Southern California Drilling Co.	2	6	11	1	Huntington Beach
Standard Oil Co.	34	5	11	Bolsa 34	Huntington Beach
Standard Oil Co.	34	5	11	Bolsa 35	Huntington Beach
World Petroleum Corp.	10	6	11	10	Huntington Beach
Frank Buttram	36	3	9	Kraemer 2	Richfield
Continental Oil Co.	33	3	9	Mullen 1	Richfield
Standard Oil Co.	34	3	9	Anaheim Union 4	Richfield
Union Oil Co.	29	3	9	Morse 8	Richfield
The Ohio Oil Co.	9	4	11	Geo. B. Miller 1	----------
Olympic Refining Co.	19	5	11	1	----------
SAN BENITO COUNTY:					
Betabel Fruit Farms	Sub. Ranc	B of ho San	Lot 6, Anto-nio	1-A	----------
Hamiltonian Oil Co.	19	16	11	2	----------
SAN BERNARDINO COUNTY:					
Del Rosa Oil and Gas Co.	13	1	4	2	----------
SAN MATEO COUNTY:					
Shell Co.	16	6	5	Butts 1	----------
SANTA BARBARA COUNTY:					
F. G. Delaney	30	9	32	1	Cat Canyon
Santa Barbara Oil Co.	3	4	29	Hollister 7-A	Goleta
Union Oil Co.	--	8	34	Purisima 19	Lompoc

OIL FIELD DEVELOPMENT OPERATIONS—Continued

Company	Sec.	Twp.	Range	Well No.	Field
VENTURA COUNTY:					
Triple A Investment Co.	5	3	19	1	Bardsdale
C. C. M. O. Co.	8	3	24	Hobson B-2	Rincon
C. C. M. O. Co.	8	3	24	Hobson C-5	Rincon
General Petroleum Corp.	8	3	24	Hobson A-2	Rincon
Pan American Petroleum Co.	17	3	24	Hobson Fee 4	Rincon
Pan American Petroleum Co.	8	3	24	Hobson Fee 6	Rincon
Pan American Petroleum Co.	8	3	24	Hobson Fee 7	Rincon
Southern Pacific Land Co.	17	3	24	2	Rincon
Southern Pacific Land Co.	17	3	24	3	Rincon
Willis W. Bryant	21	4	21	2	Santa Paula
Henry DeMond	19	4	19	1	Sespe
Emma F. Exline	33	3	21	1	South Mountain
Associated Oil Co.	23	3	23	Dabney-Lloyd 2	Ventura
Associated Oil Co.	27	3	23	Lloyd 25	Ventura
Associated Oil Co.	27	3	23	Lloyd 54	Ventura
Associated Oil Co.	23	3	23	Lloyd 55	Ventura
Associated Oil Co.	23	3	23	McGonigle 3	Ventura
Associated Oil Co.	23	3	23	V. L. & W. 7	Ventura
Associated Oil Co.	23	3	23	V. L. & W. 8	Ventura
Shell Co.	28	3	23	Gosnell 26	Ventura
H. A. Walters	21	3	23	1	Ventura
Shell Co.	35	2	22	McGrath 1	----------
Standard Oil Co.	22	2	22	Eaton 1	----------
Standard Oil Co.	14	2	22	Ferro 1	----------
Standard Oil Co.	15	2	22	Saticoy-Citrus 3	----------

ADMINISTRATIVE DIVISION

WALTER W. BRADLEY, Deputy State Mineralogist.

Personnel.

Mr. Henry H. Symons of Berkeley has been appointed Statistician and Curator, and will have charge of the mineral exhibits of this division in addition to handling the statistics of the mineral production of California. These branches of the work have been handled by Mr. Walter W. Bradley since 1916, and in conjunction with his duties as deputy state mineralogist since 1923 because of the curtailment of the funds of the division. Pressure of administrative work compels and available funds now permit segregation of this work. Mr. Symons is a graduate of the School of Mines of the University of Montana, with mining experience in Montana and California.

New Publications.

During the quarterly period covered by this issue, the following publications of the Division of Mines and Mining have been made available for distribution:

Mining in California (quarterly), October, 1927, being Chapter 4 of State Mineralogist's Report XXIII. Price 25 cents. This chapter contains a report on the Mineral Resources of Mono County; also the Index for Report XXIII, covering the four quarterly chapters of 1927.

Summary of Operations, California Oil Fields, Vol. 13, Nos. 3, 4, 5, September, October and November, 1927, respectively. These contain articles on: 'Seal Beach Oil Field'; 'Loss of Production Due to Improper Completion Methods'; and 'Landing and Cementing Long Water Strings'.

Commercial Mineral Notes, Nos. 59, 60, February and March, 1928, respectively. These 'notes' contain the lists of 'mineral deposits wanted' and 'minerals for sale' issued in the form of a mimeographed sheet monthly. It is mailed free to those on the mailing list for 'Mining in California.'

Mails and Files.

The Division of Mines maintains, in addition to its correspondence files and the library, a mine file which includes original reports on the various mines and mineral properties of all kinds in California.

During each quarterly period there are several thousand letters received and answered at the San Francisco office alone, covering almost every phase of prospecting, mining, and developing mineral deposits, reduction problems, marketing of refined products, and mining law. In addition to this, hundreds of oral questions are answered daily, both at the main office and the district offices, for the many inquirers who come in for personal interviews and to consult the files and library.

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DIVISION OF MINERALS AND STATISTICS

STATISTICS, MUSEUM, LABORATORY

HENRY H. SYMONS, Statistician and Curator.

STATISTICS

California continues to produce commercially, as for some years past, more than 50 different mineral substances, the total value of which for 1927 was estimated at $377,205,000 (see January issue of MINING IN CALIFORNIA, page 61).

At the present writing (April 1st), reports are in hand from most of the producers. Data for several substances are now complete and have been compiled, being presented herewith.

Information at hand indicates that there was no production in California during 1927 of the following substances, which have at one time or another in the past been on the active list here: asbestos, arsenic, bismuth, fluorspar, mica, molybdenum, serpentine, sulphur, strontium, tin. There was production by a single operator in each of the following: Andalusite, antimony, bromine, calcium chloride, graphite, and lithia, the figures for which will have to be combined under the 'unapportioned' item in the final report. The first production of titanium minerals in commercial quantity in California was recorded last year. The production was made from the minerals ilmenite and rutile. Titanium is used in alloys of steel, in paint employed for protecting iron and steel and is also valuable in the dyeing industry.

BARYTES

Commercial shipments of crude barytes in California during 1927 amounted to a total of 17,993 tons valued at $90,617 f.o.b. rail-shipping point, being a marked increase in both quantity and value over the 1926 figures of 4978 tons and $38,165. The 1927 yield came from properties in Mariposa, Nevada and Orange counties. The barytes from Mariposa and Nevada counties was consumed principally in the manufacture of lithopone. That from Orange County was a furnace sinter, being a barytes gangue in a quicksilver ore, and was sold for use in oil-well drilling mud.

The plant of the Chemical and Pigments Company at Oakland, Alameda County, with a capacity of 25 tons of lithopone daily, continued operations during the year. This plant will thus afford an outlet for some of California's zinc ore as well as for barytes.

More than half of the total tonnage of barytes utilized in the United States is taken in the manufacture of lithopone, which is a chemically-prepared white pigment containing approximately 70% barium sulphate and 30% zinc sulphide. This is one of the principal constituents of 'flat' wall paints. Other important uses for barytes, after washing and grinding, are as an inert pigment and filler in paint, paper, linoleum, oilcloth and rubber manufacture and in the preparation of a number of chemicals, including barium binoxide, carbonate, chloride, nitrate, and the sulphate precipitated, or 'blanc fixe.'

BITUMINOUS ROCK

This material is essentially an uncemented sandstone which is saturated with and held together by a natural asphaltic constituent, probably the residue from the evaporation of a crude petroleum deposit. Bituminous rock is still used to a limited extent for road dressing in those districts adjacent to available deposits, though the manufacture of asphalt at the oil refineries has almost entirely superseded the direct use of the native material. The present operators of the Old City Street Improvement Company's quarry in Santa Cruz County advise that they are now putting on the market a material which can be laid cold. It will be especially applicable and valuable for patching jobs. Shipments from quarries in Santa Barbara and Santa Cruz counties in 1927 totaled 3515 tons of bituminous rock, valued at $17,704 f.o.b. rail-shipping point.

CEMENT

Cement is the most important single structural material in the mineral output of California. During 1927 there was produced a total of 14,661,783 barrels valued at $25,430,763 f.o.b. plant, being an increase of over half a million barrels in quantity, but only slightly in total value owing to a small drop in prices. The 1926 output was 13,797,173 barrels, valued at $25,269,678, or an average of $1.84 per barrel. The 1927 average was $1.80 per barrel.

The 1927 production came from twelve operating plants in ten counties, and employed a total of 3803 men. The three plants in San Bernardino County made a total of 5,557,339 barrels, valued at $9,823,-839, the balance of the state's product coming from a single plant in each of the following counties: Calaveras, Contra Costa, Kern, Merced, Riverside, San Benito, San Mateo, Santa Cruz and Solano. The new plant of the Yosemite Portland Cement Company at Merced began operations and made commercial shipments in 1927.

CHROMITE

Chromic iron ore or chromite to the amount of 225 short tons, recalculated to the basis of 45% Cr_2O_3, valued at $5,063 f.o.b. shipping point, was sold during the year 1927 in California.

The principal use of chromium is in alloys of steel and refractories, though it is also used in chemicals, the latest development of which is chromium plating. It is hoped that the development of the steel industry and the resumption of copper smelting on the Pacific Coast may create some demand for California's chromite, but the outlook for the immediate future is not encouraging.

PYRITE

A total production of 130,910 tons of pyrite valued at $564,823 was reported shipped in California during 1927, from properties in Alameda, Mariposa, San Benito and Shasta counties. This was an increase both in quantity and value over the figures of 100,896 tons and $466,088 in 1926.

The pyrite shipped had a sulphur content ranging up to 46.5% S. It is mostly used in the manufacture of sulphuric acid for explosives and fertilizers, though a portion is utilized directly in the preparation of agricultural fertilizer and insecticides.

This does not include the large quantities of pyrite, chalcopyrite and other sulphides which are otherwise treated for their valuable metal contents. Some sulphuric acid is annually made as a by-product in the course of roasting certain tonnages of Mother Lode auriferous concentrates while under treatment for their precious metal values.

MUSEUM

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections in North America; and contains not only specimens of most of the known minerals found in California, but much valuable and interesting material from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well as by those who utilize the facilities of the collection.

The exhibit is daily visited by engineers, students, business men and prospectors as well as tourists and mere sightseers. Besides its practical use in the economic development of California's mineral resources, the collection is a most valuable educational asset to the state and to San Francisco.

LABORATORY

FRANK SANBORN, Mineral Technologist.

Minerals containing the rare-earth metals are occasionally received at this laboratory for identification. Such minerals have come from Tulare and Riverside counties, but so far no commercial production has been reported from these sections of the state. A mineral was received a day or so ago from Riverside County that may be cerite, but as yet has not been identified exactly.

The rare earths are usually found associated with one another, cerium being the most abundant of these elements. The chief use of cerium is in the preparation of an iron alloy called ferrocerium. This alloy is hard and brittle, and will, upon being struck or filed, give off a shower of sparks, which fact makes the composition valuable in the manufacture of ignition devices. There are other minor uses for cerium, such as in the making of chemicals and incandescent mantles. There is no settled market for cerium.

Over 1300 samples were received and determined at this laboratory during the three-month period covered by this report.

LIBRARY

E. A. Lowe, Librarian.

In addition to the numerous standard works, authoritative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the Division of Mines and Mining contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, Mining in California contains under this heading a list of all books and official reports and bulletins received, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the state are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

OFFICIAL PUBLICATIONS RECEIVED

Governmental.

U. S. Geological Survey:

Professional Paper 152—Geography, Geology and Mineral Resources of Part of Southeastern Idaho. By Geo. Rogers Mansfield.

Professional Paper 150–C—A Section of the Kaibab Limestone in Kaibab Gulch, Utah. By L. F. Noble.

Bulletin 795–F—The Gilbert District Nevada. By Henry G. Ferguson.

Bulletin 795–G—Phosphate Rock in the Three Forks-Yellowstone Park Region, Montana. By D. Dale Condit, E. H. Finch and J. T. Pardee.

Bulletin 795–H—A Manganese Deposit of Pleistocene Age in Bannock County, Idaho. By D. F. Hewett.

Bulletin 796–B—Geology and Oil and Gas Prospects of Northeastern Colorado. By Kirtley F. Mather, James Gilluly and Ralph G. Lusk.

Bulletin 796–C—Geology and Coal Resources of the Salina Canyon District, Sevier County, Utah. By Edmund M. Spieker and Arthur A. Baker.

Bulletin 796–D—Geology and Oil and Gas Possibilities of the Bell Springs District, Carbon County, Wyoming. By C. E. Dobbin, H. W. Hoots and C. H. Dane.

Bulletin 797–A—Mineral Industry of Alaska in 1926 and Administrative Report. By Philip S. Smith.

Bulletin 788–E—Topographic Instructions of the U. S. Geological Survey.

Water Supply Paper 596–G—Chemical Character of Florida. By W. D. Collins and C. S. Howard.

Water Supply Paper 596–H—Notes on Practical Water Analysis. By W. D. Collins.

Water Supply Paper 596–F—Laboratory Tests on Physical Properties of Water-Bearing Materials. By Norah Dowell Stearns.

Annual Report of the Director to the Secretary of the Interior for the Fiscal Year Ended June 30, 1927.

U. S. Bureau of Mines:

Technical Paper 403—Hydraulic Classification, Its Theory, Mechanical Development and Application to Ore Dressing. By A. W. Fahrenwald.

Technical Paper 417—Analyses of Indiana Coals. By W. N. Logan.

Technical Paper 420—Geophysical Methods of Prospecting. By A. E. Eve and D. A. Keys.

Technical Paper 437—Coke-Oven Accidents in the United States. By William W. Adams.

Bulletin 222—The Metallurgy of Quicksilver. By L. H. Duschak and C. N. Schuette.

Bulletin 229—Fifty-nine Coal-Mine Fires. By G. S. Rice, J. W. Paul and M. M. von Bernewitz.

Bulletin 245—Mining of Thin Coal Beds in the Anthracite Region of Pennsylvania. By Dever C. Ashmead.

Bulletin 274—Potash Mining in Germany and France. By Geo. S. Rice and John A. Davis.

Bulletin 277—Safety in Coal Mining (A Handbook). By Geo. S. Rice.

Bulletin 283—Coal-Mine Fatalities of the United States, 1926.

Bulletin 287—Gases from Blasting in Tunnels and Metal-Mine Drifts. By E. D. Gardner.

Bulletin 289—Petroleum Refinery Statistics, 1926. By G. R. Hopkins.

Mineral Resources of the United States:

Abrasive Materials in 1926.

Asbestos in 1926.

Coal in 1925.

Coke and By-Products in 1925.

Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1926.

Lead and Zinc Pigments and Salts in 1926.

Lead in 1926.

Magnesium and Its Compounds in 1926.

Manganese and Manganiferous Ores in 1926.

Mica in 1926.

Phosphate Rock in 1926.

Potash in 1926.

Rare Metals in 1926.

Sand and Gravel in 1926.

Secondary Metals in 1926.

Silver, Copper, Lead and Zinc in the Central States in 1926.

Stone in 1926.

Talc and Soapstone in 1926.

Zinc in 1926.

Reports of Investigations:

Serial No.

2843—The Sulphur Content of Commercial Motor Fuels. By A. J. Kraemer, E. C. Lane, and C. S. Luce.

(Results of tests of samples collected by the Bureau of Mines in July, 1927; with the conclusion that the sulphur content of most commercial gasoline is less than 0.10 per cent.)

2844—Coal-Mine Fatalities in November, 1927. By W. W. Adams.

(Discusses fatality rates and gives detailed statistical tabulations of the number and causes of coal-mine accidents.)

2845—Consumption of Explosives in November, 1927. By W. W. Adams.

(Statistical analysis of production and sales.)

2846—Properties of Calif. Crude Oils III; Additional Analyses. By A. J. Kraemer.

(The third of a series of papers on the characteristics of representative California petroleums.)

2847—Prevention of Hydrogen Sulphide Poisoning in Handling and Refining High-Sulphur Petroleums. By H. C. Fowler.

(Discusses the occurrence, physiological effects and dangers of hydrogen sulphide which is frequently a serious health and safety problem in the petroleum industry. Describes a method of detecting the gas and outlines safety measures.)

2848—Accident-Severity Rates for Certain Mines and Quarries. By W. W. Adams.

(Analysis and tabulation of data submitted in the National Safety Competition for the "Sentinels of Safety" trophy.)

2849—Analyses of Crude Oils from the West Texas District. By A. J. Kraemer, Peter Grandone, and C. S. Luce.

(Brief production histories of the several fields in the district and detailed analyses of oil samples from them.)

2850—Stocks of Petroleum Products held by Exporters. By G. R. Hopkins.

(Statistical analysis of such stocks during the year 1927 and of exports during 1925–26, with an alphabetical list of exporting companies.

2851—The Wire Saw in Slate Quarrying. Supplementary Report. By J. R. Thoemen.

(Results of further successful tests in Pennsylania slate quarries with this novel device recently introduced from Europe.)

2852—Consumption of Reagents Used in Flotation, 1926. By Thomas Varley.

(Statistical summary, with explanatory comment, covering use of a wide variety of chemicals and oils in the flotation process in the metallurgical plants of the United States.)

2853—The Resistance of Coal Mine Entries to the Flow of Air. By H. P. Greenwald and G. E. McElroy.

(Deals with fourth phase of an extensive research on coal-mine ventilation factors, referring especially to the resistance caused by right-angle bends.)

2854—Additions, Removals and Changes in Permissible List of Explosives from July 1, 1927, to January 31, 1928. By G. St. J. Perrott and J. E. Tiffany.

(Supplements complete list of explosives tested and approved by Bureau of Mines, which was published in Serial 2818, dated June 30, 1927.)

2855—Chambering Cut-Holes of Drift Rounds in a Western Metal Mine. By E. D. Gardner.

(Describes methods of chambering cut-holes in firing standard drift rounds at an Arizona mine, and points out that the practice could probably be used to advantage in blasting operations in other metal mines where ground is difficult to break.)

2856—Status of Rock-Dusting in the United States. By D. Harrington, J. J. Forbes, and F. Feehan.

(Reviews progress made in the movement for rock-dusting of all bituminous coal mines as a preventive of mine explosions. Shows that, while the movement has progressed considerably, many mining communities are slow to take advantage of this effective safeguard.)

2857—A Comparison of Ground Temperatures at Different Depths and Temperature Fluctuations of the Atmosphere. By E. L. Rawlins and T. W. Johnson.

(Gives results of tests conducted at Bartlesville, Oklahoma, to obtain information as to proper depth for burying natural gas pipe lines to minimize temperature fluctuations and thus prevent excessive leakage of gas due to explosion and contraction in the pipe joints.)

2858—Tests of Atmospheres in Chesapeake and Ohio Railroad Tunnels Between Clifton Forge, Virginia, and Hinton, West Virginia. By R. R. Sayers, L. B. Berger, and W. P. Yant.

(Detailed report of several tests made to determine temperature, humidity, and composition of tunnel atmospheres and their physiological effects on enginemen.)

Information Circulars:

Serial No.

6056—Prevention of Accidents with Explosives in the Tri-State Zinc and Lead Ore Producing District. By S. P. Howell.

(Results of Observations concerning blasting practice in Missouri-Kansas-Oklahoma zinc and lead district, with special reference to the prevention of misfires and of accidents while charging and from premature explosions.)

6057—The Determination of Carbon Monoxide in Mines with the "Iodine Pentoxide" Detector. By G. S. McCaa and John A. Davis.

(A concise description, intended especially for mine-rescue workers, of a device and method which determines the amount of carbon monoxide in mine air quickly, simply, and with reasonable accuracy.)

6058—List of Permissible Mining Equipment.

(Includes all mining equipment tested and approved by the Bureau of Mines, with special reference to safety, to January 1, 1928.)

6059—Accident Prevention Measures at the Moctezuma Copper Company. By E. D. Gardner.

(Outlines safety measures employed by a mining company at Pilares, Mexico, which is making a noteworthy record in the prevention of accidents.)

6060—Work of the Experiment Stations of the Bureau of Mines. By A. C. Fieldner and Alden H. Emery.

(Gives an outline of the various technologic investigations being conducted at the experiment stations and offices of the Bureau of Mines located in the different mining fields.

6061—Sources and Distribution of Major Petroleum Products, Central United States—1926. By E. B. Swanson and A. H. Redfield.

(A statistical summary, completing a series of regional studies pertaining to the distribution of petroleum products, inaugurated for the purpose of presenting central fundamental statistics pertaining to the industry.)

U. S. Army: Annual Report of the Chief of Engineers, Part 1 and Part 2.

U. S. Coast and Geodetic Survey: Seismological Report, April, Map, June, 1926. Serial No. 406. By Frank Neumann.

California State Library: News Notes of California Libraries.

Colorado Geological Survey:

Bulletin 3—Geology and Ore Deposits of the Alma District. By Horace B. Patton, Arthur J. Hoskin and G. Montague Butler.

Bulletin 4—Geology and Ore Deposits of the Monarch and Tomichi Districts, Colorado. By R. D. Crawford; and

Bulletin 5—Part I, Reconnaissance of the Geology of the Rabbit Ears Region. By F. F. Grout, P. G. Worcester and Junius Henderson.

II, Permian or "Permo-Carboniferous" of the Eastern Foothills of the Rocky Mountains in Colorado. By R. M. Butters.

Bulletin 7—Bibliography of Colorado Geology and Mining with Subject Index from the Earliest Explorations to 1912. By Olive M. Jones.

Bulletin 13—Geology and Ore Deposits of the Platoro-Summitville Mining District, Colorado. By Horace B. Patton.

Bulletin 16—Radium, Uranium and Vanadium Deposits of Southwestern Colorado. By R. C. Coffin.

Bulletin 17—Twin Lakes District of Colorado. By J. V. Howell.

Bulletin 18—Fluorspar Deposits of Colorado. By Harry A. Aurand.

Bulletin 21—The Geology of the Ward Region, Boulder County, Colorado. By P. G. Worcester.

Bulletin 22—Mineral Deposits of the Western Slope. By H. A. Aurand.

Bulletin 24—Some Anticlines of Western Colorado.

Bulletin 26—Preliminary Report on the Underground Waters of a Part of Southeastern Colorado. By R. C. Coffin and A. J. Tieje.

Bulletin 27—Part I, Underground Water Possibilities of La Junta Area, Colorado.

II, Water Resources of Parts of Crowley and Otero Counties.

III, Geology of Parts of Las Animas, Otero, and Bent Counties.

Bulletin 28—Oil and Water Possibilities of Parts of Delta and Mesa Counties, Colorado. By Herbert H. Weeks.

Bulletin 30—Geology and Ore Deposits of the Red Cliff District, Colorado. By R. D. Crawford and Russell Gibson.

Bulletin 31—Geology of the Tarryall District, Park County, Colorado. By Garrett A. Muilenburg.

Connecticut State Geological and Natural History Survey:
Bulletin 40—The Geology of the Shepaug Aqueduct Tunnel, Litchfield County, Connecticut. By William Macdonough Agar, with a chapter by Robert A. Cairns.
Bulletin 41—Guide to the Geology of Middletown, Connecticut, and Vicinity. By William North Rice and Wilbur Garland Foye.

Florida Geological Survey: Eighteenth Annual Report of.

Illinois State Geological Survey:
Bulletin 31—Coal Stripping Possibilities in Southern and Southwestern Illinois. By G. H. Cady.
Press Bulletin 13—Illinois Petroleum. By A. H. Bell and L. E. Workman.
Press Bulletin 14—Illinois Petroleum. By Gail F. Moulton and Jackson Young.
Report of Investigation 13—Stratigraphy and Geologic Structure of Northern Illinois, with Special Reference to Underground Water Supplies. By F. T. Thwaites.
Report of Investigation 15—Preliminary Report on the Fuller's Earth Deposits of Pulaski County. By J. E. Lamar.

Kansas State Geological Survey: Bulletin 13—Underground Resources of Kansas. By Raymond C. Moore and Kenneth K. Landes.

Kansas State Inspector of Oils: Annual Report of, December, 1926, to November 30, 1927.

Kentucky Geological Survey:
Nest of Sinking Streams. By Dr. Willard R. Jillson.
Topography of Kentucky. By Willard Rouse Jillson.

North Carolina Department of Conservation and Development: Bulletin 34—Discharge Records of North Carolina Streams, 1889–1923.

Ohio Geological Survey:
Bulletin 31—Geology of Vinton County. By Wilbur Stout.
Bulletin 32—Fauna of the Silica Shale of Lucas County. By Grace Anne Stewart.

Oklahoma Geological Survey:
Bulletin 42—Mineral Resources in Oklahoma. By John S. Redfield.
Bulletin 43—Oil Sands and Production Relations. By H. C. George and W. F. Cloud.

Pennsylvania Department of Internal Affairs: Bulletin 92—Topographic and Geologic Survey—Anthracite Culm and Silt. By James D. Sisler.

Tennessee Division of Geology. Bulletin 34—Water Resources of Tennessee. By Warren R. King.

Virginia Geological Survey: Bulletin 30—Geology of the Gold-Pyrite Belt of the Northeastern Piedmont, Virginia. By John T. Lonsdale.

Australasian Institute of Mining and Metallurgy: Proceedings of the, No. 64 and No. 66.

Australian Museum: Records of the, Vol. XVI, No. 3.

Barcelona, Real Academia de Ciencias y Artes de, Memorias de la, Vol XX;
Num. 7—Los Movimientos Ritmicos en las Celulas.
Num. 8—Itinerario Geologico A Traves del Bajo Aragon y el Maestrazgo.
Num. 9—De Algunas Causas de Instabilidad en las Iglesias Goticas.
Num. 10—Accion de la Luz en Los Repoblados de Robles.
Num. 11—Algunos Prejuicios Geograficos.
Num. 12—Acustica de las Salas de Aduicion.

Bulgarian Geological Survey: Review of, Jahrg 1 Heft 1, 1927.

Canada Department of Mines: Report of the, for the Fiscal Year Ending March 31, 1927.

Canadian Mining and Metallurgical Bulletin No. 189, No. 190, No. 191.

Finland Geologiska Kommissionen: Bulletin 79—Studien Uber den Gesteinsaufbau der Kittil-Lappmark. von Victor Hackman.

Great Britain Society of Chemical Industry: Hydrocarbon Synthesis from Carbon Monoxide and Hydrogen. By Oliver C. Elvins.

Institution of Petroleum Technologists: Possible Auxiliary Sources of Liquid Fuels. By Prof. Alfred W. Nash.

Mexico Secretaria de Industria, Comercio y Travajo: Reglamento de Trabajos Petroleros. Boletin Minero, Tomo XXV, Numero 2.

Montevideo: Anales del Museo de Historia Natural de, Serie II, Tomo II.
New Zealand Department of Scientific and Industrial Research: Sixtieth Annual Report of the Dominion Laboratory. By J. S. Maclaurin.
Ontario Department of Mines:
Thirtieth Annual Report of the, Vol. XXXVI, Part III, 1827.
Bulletin 64—Preliminary Report on the Mineral Production of Ontario in 1927.
Philippine Journal of Science: Vol. 34, No. 3; No. 4.
Republica de Colomboa Biblioteca del Museo Nacional: Notas Geograficas y Geologicas. Por Ricardo Lleras Codazzi.
Los Minerales de Colomboa. Por Ricardo Lleras Codazzi.
Rio de Janeiro Museu Nacional: Boletin, Vol. III, No. 3; No. 2.
South Australia Department of Mines:
Mining Review for the Half-Year Ended June 30, 1927, No. 46.
Annual Report of the Director of Mines and Government Geologist for 1926.
Transvaal Chamber of Mines: The Gold of the Rand.
U. S. S. R., Mineral Resources of the:
Aluminum and Bauxite. By S. Maliavkin.
Part 11—Bismuth. By C. P. Denguin.
Part 12—Tungsten. By G. Denguin.
Part 20—Cadmium. By N. Boerling and V. Lyjin.
Part 24—Manganese. By A. J. Serck.
Part 27—Arsenic. By S. Konstantov.
Part 37—Quicksilver. By N. Boerling, S. Konstantov and M. Likhareva.
Bulletins du Comite Geologique:
Vol. XLI, No. 6–9; XLI, No. 10; XLV, No. 3; XLV, No. 4; XLV, No. 5; XLV, No. 6; XLV, No. 7; XLV, No. 8; XLV, No. 9; XLV, No. 10; XLVI, No. 1; XLVI, No. 2; XLVI, No. 3; XLVI, No. 4; XLVI, No. 5; XLVI, No. 6; XLVI, No. 7; XLVI, No. 8–9; XLV, No. 2; XLIV, No. 10; XLIV, No. 9; XLIV, No. 8.
Annual Report of the Mineral Resources of the U. S. S. R. during the Fiscal Year 1925–26.
Livarison 74—Lower Carboniferous Cephalopoda from the Son-Kul Region (Tien-Shan Mountains).
Livarison 56—Description Geologique des Environs des Sources Minerals de Matsesta et d'Angora.

Societies and Educational Institutions.

Birmingham, University of, Department of Oil Engineering and Refining: A Note on Gas Analysis. By H. M. Stanley and A. W. Nash.
California, University of:
Northwestern Continuation of the San Onofre Breccia. By A. O. Woodford and T. L. Bailey.
The Occurrence of Phylogenetic Status of Merycodus from the Mohave Desert Tertiary. By E. L. Furlong.
The Geology and Paleontology of the Type Section of the Meganos Formation (Lower Middle Eocene) of California. By Bruce L. Clark and A. O. Woodford. A New Species of Eocene Coral, Archohelia Clarki, from California. By Thomas Wayland Vaughan.
Colorado School of Mines Magazine, Vol. 17, No. 10.
Columbia University: Bulletin of Information, 28th Series, No. 20.
Harvard University:
McGovernite, a New Mineral from Sterling Hill, New Jersey. By C. Palache and L. H. Bauer.
Dehydration and Optical Studies of Alunogen, Nontronite and Griffithite. By Esper S. Larsen and George Steiger.
The Hiddenite Occurrence in North Carolina. By S. C. Davidson.
Minnesota, University of:
Bulletin 237—Rations for Fattening Baby Beeves and the Selection of Calves for Baby Beef Production.
Bulletin 238—Forest Planting Experiments in Minnesota.
Bulletin 239—Soybeans and Soybean Hay in the Dairy Ration.
Missouri, University of:
Properties of Refractories in Zinc Metallurgy. By E. S. Wheeler, A. H. Kuechler and H. M. Lawrence.

Oregon, University of: Vol. 1, No. 2—A Quantitative Mineralogical and Chemical Classification of Igneous Rocks. By Edwin T. Hodge.
Strasbourg, Universite de: Memoires du Service de la Carte Geologique d'Alsace et de Lorraine.
Tohoku Imperial University, Sendai, Japan: The Science Report of the, Second Series (Geology). Vol. X, No. 4.
Waseda University, Tokyo, Japan: Memoirs of the Faculty of Science and Engineering, No. 5.
American Institute of Mining and Metallurgical Engineers: Transactions of, Vol. LXXV.
American Philosophical Society: Proceedings of the, Vol. LXVI, 1927.
Economic Geology, Vol. XXIII, No. 1; No. 2.
Engineers' Society of Western Pennslyvania: Proceedings of the, Vol. 43, No. 8.
Institution of Mining and Metallurgy: Bulletin 279—December, 1927; No. 280, Jan. 1928.
Mineralogical Society of America: Journal of the American Mineralogist, Vol. 13, No. 3; No. 4.
Philadelphia, The Academy of Natural Sciences of: Proceedings of, Vol. LXXIX.
Smithsonian Institution:
Newly Discovered Meteoric Irons from the Wallapai (Hualapai) Indian Reservation, Arizona.
Rossite and Metarossite, Two New Vanadates from Colorado.
Western Society of Engineers: Journal, Vol. XXXII, No. 10; No. 11.

Maps.

Topographic Maps:

Arlington Heights, Ill.
Arnoldsburg, W. Va.
Belington, W. Va.
Blum, Texas.
Burnsville, W. Va.
Galesburg, Ill.
Glendora, Calif.
Graham, Tex.
Grosvenor, Tex.
Hillsboro, Wis.
Hinsdale, Ill.
Holderness, N. H.
Iaeger, W. Va.–Va.
La Habra, Calif.
Mineral Wells, Tex.
New Braunfels, Tex.
Pagosa Springs, Colo.
Pearsall, Tex.
Pierce Pond, Me.
Rocky Mount, Va.
Shell Knob, Mo.
Smithson Valley, Tex.
Streator, Ill.

Books.

Handbook of Ore Dressing, Taggart.
Chemical Engineering Catalog, 1926.

Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

American Petroleum Institute, New York.
Architect and Engineer, San Francisco.
Arizona Mining Journal, Phoenix, Arizona.
Asbestos, Philadelphia, Pennsylvania.
Brick and Clay Record, Chicago.
Bulletin, Union Oil Co., Los Angeles.
California Journal of Development, San Francisco.
Cement, Mill and Quarry, Chicago, Illinois.
Chemical-Engineering and Mining Review, Melbourne, Australia.
Engineering and Mining Journal, New York.
Explosives Engineer, Wilmington, Del.
Financial Insurance News, Los Angeles, California.
Graphite, Jersey City.
Journal of Electricity and Western Industry, San Francisco.
Metallurgical and Chemical Engineering, New York.
Mine and Quarry, Chicago.

Mining and Engineering Record, Vancouver, B. C.
Mining and Oil Bulletin, Los Angeles.
Oil Age, Los Angeles.
Oil and Gas Journal, Tulsa, Oklahoma.
Oil and Gas News, Kansas City.
Oil News, Galesburg, Illinois.
Oildom, New York.
Oil, Paint and Drug Reporter, New York.
Oil Trade Journal, New York.
Oil Weekly, Houston, Texas.
Petroleum Age, New York.
Petroleum Record, Los Angeles.
Petroleum World, Los Angeles.
Queensland Government Mining Journal, Brisbane, Australia.
Rock Products, Chicago, Illinois.
Safety News, Industrial Accident Commission, San Francisco.
Salt Lake Mining Review, Salt Lake City, Utah.
Southwest Builder and Contractor, Los Angeles.
Standard Oil Bulletin, San Francisco.
Stone, New York.
The Record, Associated Oil Company, San Francisco.
Through the Ages, Baltimore.

Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.
Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).
Barstow Printer, Barstow, Cal.
Blythe Herald, Blythe, Cal.
Bridgeport Chronicle-Union, Bridgeport, Mono Co., Cal
Calaveras Prospect, San Andreas, Cal.
California Oil World, Los Angeles, Cal.
Cloverdale Reveille, Cloverdale, Cal.
Colusa Daily Sun, Colusa, Cal.
Daily Commercial News, San Francisco, Cal.
Daily Midway Driller, Taft, Cal.
Del Norte Triplicate, Crescent City, Cal.
Exeter Sun, Exeter, Cal.
Gateway Gazette, Beaumont, Cal.
Goldfield News, Goldfield, Nevada.
Guerneville Times, Guerneville, Cal.
Healdsburg Enterprise, Healdsburg, Cal.
Humboldt Standard, Eureka, Cal.
Inyo Independent, Independence, Cal.
Inyo Register, Bishop, Cal.
Ione Valley Echo, Ione, Cal.
Lake County Bee, Lakeport, Cal.
Mining and Financial Record. Denver, Colo.
Mountain Democrat, Placerville, Cal.
Mountain Messenger, Downieville, Cal.
Nevada Mining Press, Reno, Nevada.
Oatman Mining News, Oatman, Arizona.
Oregon Observer, Grants Pass, Oregon.
Oroville Daily Register, Oroville, Cal.
Petroleum Reporter, Taft, Cal.
Placer Herald, Auburn, Cal.
Plumas Independent, Quincy, Cal.
Plumas National Bulletin, Quincy, Cal.
Randsburg Times, Randsburg, Cal.
San Diego News, San Diego, Cal.
Shasta Courier, Redding, Cal.
Siskiyou News, Yreka, Cal.
Stockton Record, Stockton, Cal.
Tuolumne Prospector, Tuolumne, Cal.
Ventura Daily Post, Ventura, Cal.
Weekly Trinity Journal, Weaverville, Cal.
Western Sentinel, Etna Mills, Cal.

PRODUCERS AND CONSUMERS

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

When the publication of MINING IN CALIFORNIA was on a monthly basis, current inquiries from buyers and sellers were summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to the present quarterly publication of MINING IN CALIFORNIA, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes,' and sent to those on the mailing list for MINING IN CALIFORNIA.

EMPLOYMENT SERVICE

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate attention.

Technical men, or those qualified for supervisory positions, and vacancies of like nature, only are registered, as no attempt will be made to supply common mine and mill labor.

A list of current applications for positions and 'positions open' is carried in each issue. Notices are designated by a key number, and the name and address corresponding to any number will be supplied upon request, without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Division of Mines and Mining, to avoid possible loss. Registration cards for the use of both prospective employers and employees may be obtained upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

POSITIONS WANTED

61–4 Mining or geological work. Technical graduate (1916). Twelve years' general mining experience in western states. Speaks fair Spanish. Will go anywhere. Age 37. Married. Salary wanted, $175, minimum. References.

61–5 Mine superintendent or assayer. Three years' experience as foreman, one as superintendent and 2 as assayer; Colorado, Texas and Mexico. Age 33. Married. References.

61–6 Milling. Eight years' varied experience as millman and mill foreman. Age 45. Single. Salary wanted, $250. References.

PUBLICATIONS OF THE DIVISION OF MINES AND MINING

During the past forty-eight years, in carrying out the provisions of the organic act creating the former California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the office of the Division of Mines and Mining, in the Ferry Building, San Francisco; New Orpheum Building, Los Angeles; Capitol Extension Building, Sacramento; Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the above offices and enclosing the requisite amount in the case of publications that have a list price. Only coin, stamps or money orders should be sent, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the Division of Mines and Mining.

REPORTS

Asterisks (**) indicate the publication is out of print.

Price

****First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks** ----

****Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks** ----

****Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks** ----

****Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks** ----

****Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks** ----

****Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. Henry G. Hanks** ----

****Part II, 1887, 222 pp., 36 illustrations. William Irelan, Jr.** ----

****Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Irelan, Jr.** ----

****Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustrations. William Irelan, Jr.** ----

****Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Irelan, Jr.** ----

****Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Irelan, Jr.** ----

REPORTS—Continued

Asterisks (**) indicate the publication is out of print.

	Price
Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps. William Irelan, Jr.	$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps. J. J. Crawford	----
**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford	----
Chapters of the State Mineralogist's Report, Biennial Period, 1913–1914, Fletcher Hamilton:	
**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper	----
Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper	.50
Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper	.25
**Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pages, paper	----
Mines and Mineral Resources of Imperial and San Diego Counties, 113 pp., paper	.35
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper	----
**Fourteenth Report of the State Mineralogist, for the Biennial Period 1913–1914, Fletcher Hamilton, 1915:	
A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth	----
Chapters of the State Mineralogist's Report, Biennial Period, 1915–1916, Fletcher Hamilton:	
**Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp., paper	----
**Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama Counties, 91 pp., paper	----
Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper	.65
Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper	.65
Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties, 136 pp., paper	.50
**Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp., paper	----
**Fifteenth Report of the State Mineralogist, for the Biennial Period 1915–1916, Fletcher Hamilton, 1917:	
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**Register of Mines, with Map, Sierra County ----
**Register of Mines, with Map, Siskiyou County ----
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**Map of California, Showing Mineral Deposits (50 x 60 in.) ----
**Map of Forest Reserves in California ----
**Mineral and Relief Map of California ----
**Map of El Dorado County, Showing Boundaries, National Forests ----
**Map of Madera County, Showing Boundaries, National Forests ----
**Map of Placer County, Showing Boundaries, National Forests ----
**Map of Shasta County, Showing Boundaries, National Forests ----
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**Map of Tuolumne County, Showing Boundaries, National Forests ----
**Map of Mother Lode Region ----
**Map of Desert Region of Southern California ----
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Map of Copper Deposits in California .05
**Map of Calaveras County ----
**Map of Plumas County ----
**Map of Trinity County ----

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**Map of Tuolumne County	----
Geological Map of Inyo County. Scale 1 inch equals 4 miles	$0.60
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Topographic Map of Sierra Nevada Gold Belt, showing distribution of auriferous gravels, accompanying Bulletin No. 92 (also sold singly) In 4 colors	.50

OIL FIELD MAPS

These maps are revised from time to time as development work advances and ownerships change.

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Map No. 2—Santa Maria, including Cat Canyon and Los Alamos	.75
Map No. 3—Santa Maria, including Casmalia and Lompoc	.75
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Map No. 31—Inglewood, Los Angeles County	.75
Map No. 32—Seal Beach, Los Angeles and Orange Counties	.75

DETERMINATION OF MINERAL SAMPLES

Samples (limited to three at one time) of any mineral found in the state may be sent to the Division of Mines and Mining for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

58735 4-28 2650.

STATE OF CALIFORNIA

DIVISION OF MINES AND MINING

CORDIALLY INVITES YOU TO VISIT
ITS VARIOUS DEPARTMENTS MAINTAINED
FOR THE PURPOSE OF FURTHERING
THE DEVELOPMENT OF THE

MINERAL RESOURCES OF CALIFORNIA

At the service of the public are the scientific reference library and reading room, the general information bureau, the laboratory for the free determination of mineral samples found in the state, and the largest museum of mineral specimens on the Pacific Coast. The time and attention of the State Mineralogist, as well as that of his technical staff, are also at your disposal.

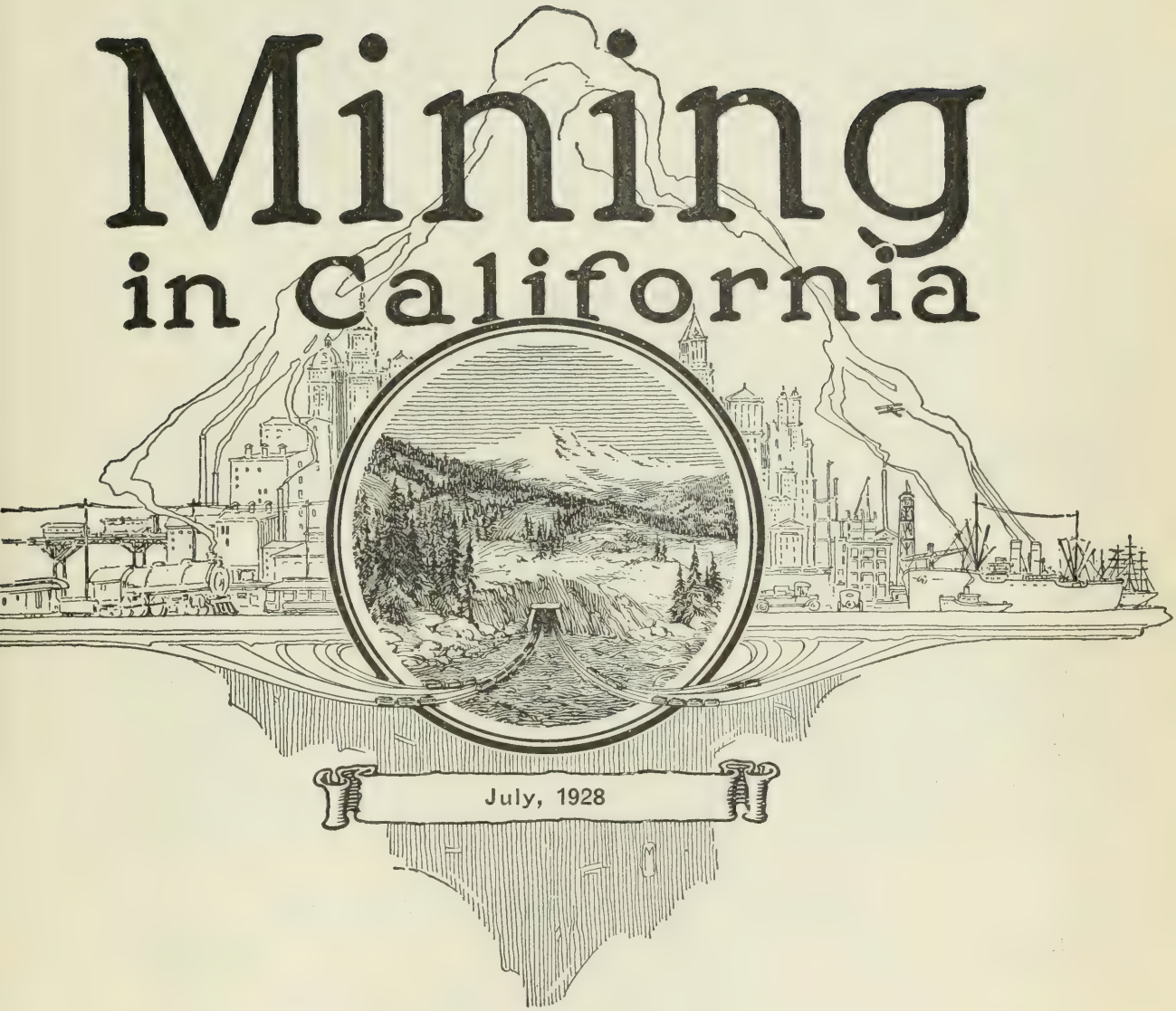
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Mining in California



July, 1928

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Note.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the Division of Mines and Mining, entitled 'Summary of Operations, California Oil Fields.'

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND MINING
FERRY BUILDING, SAN FRANCISCO

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CHAPTER OF

REPORT XXIV OF THE STATE MINERALOGIST

COVERING

MINING IN CALIFORNIA

AND THE

ACTIVITIES OF THE DIVISION OF MINES AND MINING



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PUBLICATIONS I


State of California
DIVISION OF MINES AND MINING
LLOYD L. ROOT
STATE MINERALOGIST
OUTLINE MAP
OF
CALIFORNIA
SCALE
OREGON
NEVADA
PACIFIC OCEAN
MEXICO
SISKIYOU
MODOC
TRINITY
SHASTA
LASSEN
HUMBOLDT
DEL NORTE
TEHAMA
PLUMAS
GLENN
BUTTE
SIERRA
MENDOCINO
LAKE
COLUSA
YUBA
NEVADA
PLACER
YOLO
EL DORADO
SONOMA
NAPA
SOLANO
AMADOR
ALPINE
MONO
MARIN
CONTRA COSTA
SAN JOAQUIN
CALAVERAS
TUOLUMNE
SAN FRANCISCO
ALAMEDA
STANISLAUS
MARIPOSA
MERCED
SANTA CLARA
SAN BENITO
FRESNO
INYO
MONTEREY
TULARE
KINGS
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
LEGEND
Mining Division Boundaries.
Mining Division Offices.

PREFACE

The Division of Mines and Mining (formerly State Mining Bureau) is maintained for the purpose of assisting in all possile ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing this was changed to quarterly publication, beginning in September, 1923.

For the same reason, beginning with the January, 1924 issue, it has been necessary to charge a subscription price of $1 per calendar year, payable in advance; single copies, 25 cents apiece. 'Mining in California' will continue to be sent without charge to our exchange list, including schools and public libraries, as are also other publications of the Division of Mines and Mining.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the practice of issuing from time to time technical reports on special subjects will be continued, as well. A list of such reports now available is appended hereto, and the names of new bulletins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Division of Mines and Mining is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.

DISTRICT REPORTS OF MINING ENGINEERS

In 1919–1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district, working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively. This move brought the office into closer personal contact with operators, and it has many advantages over former methods of conducting field work. In 1923 the Redding and Auburn field offices were consolidated and moved to Sacramento.

The Redding office was reestablished in 1928, and the boundaries of each district adjusted. The counties now included in each of the four divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

New County Reports

The series of separate reports on the mines and mineral resources of the different counties, that together comprise the State Mineralogist's Reports XIV to XVII, inclusive, in the case of many of the counties have become exhausted. Those still in stock are in need of revision. It was deemed advisable, therefore, beginning with the January, 1925, issue of 'Mining in California,' to make the district engineers' reports in the form of a complete general report on the mines and mineral resources in one or more of the counties in each district.

This program will be followed as near as possible in succeeding numbers of the quarterly until each county in the state has been covered.

SACRAMENTO FIELD DIVISION

C. A. Logan, Mining Engineer.

BUTTE COUNTY

Geography

The western half of Butte County lies in the Sacramento Valley and is entirely an agricultural region, while to the north and east of Oroville the foothills rise into mountain ridges several thousand feet high, separated by deep canyons occupied by the forks of Feather River.

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The western half of Butte County lies in the Sacramento Valley and is entirely an agricultural region, while to the north and east of Oroville the foothills rise into mountain ridges several thousand feet high, separated by deep canyons occupied by the forks of Feather River.

The Southern Pacific Railroad's Shasta Route traverses the western or valley portion from north to south, with a branch through Honcut to Oroville, and another from Chico to Stirling City via Magalia. The Western Pacific Railway, entering Oroville from the south, follows the canyon of the North Fork of Feather River northeastward into Plumas County. The Sacramento Northern, an electric short line, runs from Sacramento north to Oroville Junction, with branches to Chico and Oroville. The county is adequately covered by a network of good roads.

Mineral Resources

The placer gold production has been heavy, and the complete record would show several times the amount in the table, as the surface placers worked in the early days were extremely rich. An estimate of $200,000,000 total gold output has been made, but there are no definite figures previous to 1880 to support this except for the Cherokee (Spring Valley) Mine. Gold quartz has yielded a few million. Next in importance has been the stone industry, in this county a by-product of gold dredging; mineral water, chromite, manganese, silver, platinum group metals, brick, lime, soapstone and mineral paint have each been produced in smaller quantities. Several hundred diamonds have been found during placer mining.

Water, Power and Timber

The drift mines in general develop from their own workings enough water for washing the small tonnages of gravel mined, and quartz mines generally have enough for milling. There is not enough water available for direct use for power, in many cases, and what there is that could be used for this purpose, is too costly, particularly in the case of the supply in the Forbestown Mining district, where the Oroville-Wyandotte Irrigation district controls the supply and charges a high price. The supply for surface placer mining is limited. The water formerly used for hydraulic mining has been taken by power companies and farmers. Pacific Gas & Electric Company operates two hydroelectric plants at De Sabla and Centerville on Big Butte Creek. Great Western Power Company of California has a large generating plant at Las Plumas.

There is a good supply of timber for mining in all of the mining districts.

Acknowledgment

The writer wishes to acknowledge with pleasure the assistance given by mine owners and operators. Special thanks are due to M. J. Cooney and George A. White, Forbestown; E. N. Understock and Nat Lambert, De Sabla; H. Bartram, Coutolenc; R. L. Phillips and A. H. Rugh, Nimshew; J. A. Moore, Maurice Reich, J. A. Pitts and Charles Bader, Magalia; John Wells and Sidney Wellington, Yankee Hill; Mr. and Mrs. Carl Johnson, Berry Creek; Howard Silsbee, Mountain House; A. Delerey, Paradise; Harry Sheehy and Forest Snow, Berdan, and G. F. Skelton, Chico.

MINERAL PRODUCTION OF BUTTE COUNTY, 1880-1927.

Year	Diamonds, value	Gold, value	Mineral water		Platinum		Silver, value	Miscellaneous stone[1], value	Miscellaneous and unapportioned		
			Gallons	Value	Ounces	Value			Amount	Value	Substance
1880		$430,501					$1,247				
1881		650,000					1,000				
1882		650,000									
1883		630,000									
1884		680,000									
1885		672,569					3,700				
1886		728,160					13				
1887		632,902					6				
1888		550,000					500				
1889		606,628					518				
1890		268,977					5,815				
1891		304,765					229				
1892		316,000					610				
1893		307,351					5,504				
1894		473,073									
1895		697,261					8,936				
1896		749,316	1,900	$775			5,390				
1897		667,025	2,160	900			7,885		700 M.	$4,200	Brick.
1898		514,508	2,685	900			9,317		250 M.	1,500	Brick.
									150 tons	3,000	Mineral paint.
1899		486,846	2,480	1,240			5,009		300 M.	1,800	Brick.
									900 tons	9,900	Mineral paint.
1900		485,589	15,000	1,515			13,082		600 bbls.	600	Lime.
1901		864,978	10,400	1,455			4,634		900 M.	7,200	Brick.
									1,500 bbls.	1,500	Lime.
1902		916,782	14,000	1,500			2,219		800 M.	5,000	Brick.
									400 bbls.	750	Lime.
									1,200 M.	7,200	Brick.
1903		1,571,507	13,000	1,550	14	$210	358		250 bbls.	250	Lime.
									190 tons.	250	Limestone.
1904		1,932,552	12,600	1,512	66	1,000	2,302		670 M.	4,020	Brick.
1905		2,607,500	15,000	1,500	110	1,770	7,134		400 M.	3,200	Brick.
1906		3,016,747	19,500	1,950	26	475	10,853		130 M.	1,300	Brick.
1907		2,780,840	21,400	2,140			8,967				
1908		3,139,398	22,450	2,450			12,708	$7,916			
1909		2,087,079	25,400	1,400			7,205		200 M.	1,200	Brick.
								32,140		107,170	Unapportioned, 1900-1909
1910		2,487,791					6,429	34,932	645 lbs.	27	Lead.
1911	$150	2,323,396					5,102	78,208			
1912		2,346,229					5,567	51,879			
1913	175	2,269,849	1,000	250			5,163	258,503			
1914	100	1,700,000	1,200	300	119	381	4,000	50,895	513 lbs.	20	Lead.
									90 lbs.	4	Lead.
1915	300	1,545,076	5,000	850	126	3,097	3,433	67,143		540	Chromite.
									11 lbs.	2	Copper.
1916	357	1,257,231	3,150	1,125	76	3,472	3,332	67,892	1,451 tons	13,940	Chromite.
										9,576	Other minerals.
									5,746 tons	104,085	Chromite.
1917	125	922,271	3,500	1,450	119	9,106	2,991	89,870	378 lbs.	32	Lead.
1918	125	645,975	3,900	1,680	114	7,723	2,410	77,822		329	Copper, manganese, natural gas.
									3,325 tons	134,535	Chromite.
1919	[2]	378,207	6,532	2,388	33	5,071	1,911	92,765		2,765	Manganese and natural gas.
1920	400	467,900	6,400	5,200	fine oz. 42	4,714	2,253	[2]		1,105	Gems and natural gas.
1921	331	456,700	2,900	4,100	31	2,432	1,759	203,900		161,095	Natural gas and miscellaneous stone.
1922	225	491,201	2,835	2,485	fine oz. 30	3,826	1,890	220,450		548	Other minerals.
1923		487,393	3,700	3,300	fine oz. 19	2,601	1,756	340,250		548	Other minerals.
										6,648	Other minerals. [3]
1924		484,530	6,000	4,500	fine oz. 20	2,829	2,118	138,000		225	Gems.
										9,548	Other minerals. [4]
1925		355,289	4,184	2,742	fine oz. 56	9,177	4,354	156,738		17,878	Other minerals. [5]
1926	175	287,853			fine oz. 10	954	2,997	147,004	273 M.	4,316	Brick.
										18,046	Other minerals. [6]
1927		143,494					371		40 lbs.	5	Copper.
									130 lbs.	8	Lead.
Totals	$2,403	$30,467,888	339,076	$51,157	1,011	$63,168	$182,606	$2,116,907		$645,865	

[1] Includes crushed rock, rubble, rip-rap, sand, gravel.
[2] See under "Unapportioned."
[3] Includes diamonds, natural gas, soapstone.
[4] Includes natural gas and soapstone.
[5] Includes brick, copper, gems (diamonds), lead, natural gas, soapstone.
[6] Includes clay (pottery), mineral water, natural gas, soapstone.

CHROMITE[1]

Chromite was found in many parts of the county between 1915 and 1918, as shown by the following tabulation, which is abstracted from our Bulletin 76, to which the reader is referred for fuller details, as there has been practically no new development in this branch of mining since 1919, and all are idle now.

The mines along the flanks of the Magalia ridge as far north as Stirling City are within hauling distance of the railroad. The deposits there are generally in the canyons where erosion has cut through the lava and soil cover and has exposed the serpentine, which occurs in lenses striking generally northwest, and carrying chromite either in bunches or as disseminated ore, the latter requiring concentration.

In the eastern part of the county, there is no lava covering. A large serpentine area is traversed by North Fork of Feather River north of Big Bend and there are other occurrences near Mountain House, Quartz Hill, three to six miles east of Forbestown and in the extreme southeast part of the county.

Table of Chromite Properties in Butte County

Name	Location Sec.	Twp.	Range	Nearest R. R. shipping point and distance
Agard & Stewart	36	23	4	1 mile Pulga
Curtis	7	21	4	Oroville
Dowden				15 miles Blinzig
Hendricks	34	22	4	Oroville
Hendricks No. 2	6	21	4	Oroville
Lambert	34	23	3	5 miles Magalia
Lucky Strike		Woodleaf		30 miles Oroville
Dickie & Dreisbach		Clipper Mills		30 miles Oroville
Noyes				
Rohrer & McCroskey	36	23	4	28 miles Oroville
Sharrer	10	19	7	30 miles Oroville
Simmons				
Stokes				
Swayne				
Union Chrome				
Wakehama	35	23	3	19 miles Oroville
Wells Mine				
Zenith	6	19	7	26 miles Oroville

CLAY

Lund Brick Plant. N. E. Lund, 290 Villa Street, Oroville, owner and operator. The plant and pit are 3.7 miles east of Coxlane spur on the Southern Pacific Railroad between Palermo and Honcut. The deposit is of interest because the clay being used overlies an auriferous gravel channel, and the removal of clay will facilitate the working of the gravel which first attracted the owner.

The following is a section of the deposit:

2 feet soil and gravel overburden.
5–6 feet red mottled sandy clay (fat).
5–6 feet red mottled sandy clay (leaner).
26 feet light sandy clay (decomposed sand).
? gold bearing channel, depth unknown, containing fine and coarse red gravel and large boulders, with a good deal of quartz.

Lund's first work was to sink five shafts averaging 40 feet deep to gravel; there are 10 such shafts in all, which were stopped before reaching bedrock by the influx of water. An adit was run 580 feet in

[1] Cal. State Min. Bur. Bull. 76, pp. 118–121; 216.

rim gravel without reaching the channel trough, and was lost by caving. A good prospect is reported.

Clay is dug with a dragline scraper, raised by bucket elevator to rolls, then elevated to a bin from which it goes to pug mill, auger machine and cutter. A set of tunnel driers has been built lately, requiring 2½ days for steam drying or four days by air circulation alone. There is also an outside drier. The capacity of machinery is 20 M daily. Oil fuel and steam power are used.

The different strata of clay have to be mixed to obtain a good red brick of pleasing color. Roofing granules are made from waste. Three shades of this, called cherry, light red and blue-red are sold. Bricks are burned in field kilns.

Professor W. F. Dietrich reported tests on material from this property and discussed its ceramic qualities in Bulletin 99 of this Division, recently published.

Table Mountain Clay Products Company has a brick plant at Thermalito and 40 acres of clay land 6 miles distant in SW¼ Sec. 22, T. 20 N., R. 3 E., on the Oroville-Pentz highway. L. F. Riley, president and manager. Frank Terrill, superintendent.

The plant has a capacity of 20,000 brick daily. Roofing tile and partition tile are made, as well as common and rug brick. The brick are of a pleasing shade, lighter than commonly seen, and of good quality.

The clay pit carries a thin basaltic capping and about 6 feet of grey volcanic mud, burning dark red. This is underlain by light-colored clay of the Ione formation, of which 4 feet is pure white. It was prospected by auger holes up to 22 feet deep and in one place 72 feet.

It is mined with scrapers and hauled to the plant in three trucks, where it is dumped to the dry pan and elevated to a bin; that coarser than 60-mesh is returned to the pan. It is worked in an auger machine and bricks are cut by hand. After drying in the sun about two weeks, bricks are burned 6 days in oil-fired field kilns of 185,000 bricks each. Machinery is operated by electric power. The plant is served by Sacramento Northern Railway.

The ceramic qualities of a sample of clay from this property were tested, and discussed by Professor W. F. Dietrich in our Bulletin 99, recently published.

COPPER

A little cement copper was produced from the concentrate at the Gold Bank Mine after chlorination. The ores of the Bonanza King prospect and the Evening Star claim (which see) carry copper, as do others noticed, but no production of this metal is being made.

FUELS

Lignite has been found in the Oroville district in wells drilled for water and oil. This lignite occurs in association with the Ione formation, which borders the foothills on the east and northeast sides of the valley. In geologic mode of occurrence it is similar to that found at Ione, Amador County, and Lincoln, Placer County, where lignite occurs interbedded in nearly horizontal, saucer-shaped bodies in clay and sand at depths seldom over 125 feet below the present surface.

Natural gas in small amount has been produced from a single well in this county.

Lott Ranch. C. F. Lott, owner, Oroville. This property is 8½ miles by road from Oroville in Sec. 12, T. 20 N., R. 3 E., in Coal Canyon, at an elevation of 500 feet. There are reported to be two strata of brown lignite at depths of 20 and 30 feet below the surface, but the old workings were obliterated by a washout and slide several years ago and the beds in place underground are not now accessible, although there is considerable lignite in the old dumps.

Between 1860 and 1880 this lignite was used in Oroville for fuel and for making gas. There is no one now alive in the neighborhood who knows the extent of the underground workings, but an old report[1] states the coal was about six feet thick and was drifted for "several hundred feet." A sample taken in 1920 by the writer from the old dump was too much oxidized to permit any test of its properties.

GEMS

Californite (California *Jade*) occurs at the Jade Mountain Mines near Pulga, on the Western Pacific Railway in the canyon of North Fork of Feather River. Some work has been done upon the property and an attractive exhibit was made at the last State Fair. J. R. Grant, 418 Turk Street, San Francisco, manager. W. H. King, Pulga, secretary.

Diamonds have been found at intervals from the early days in the placer mines of Cherokee and Morris Ravine and these finds have continued up to the present time, although mining has almost ceased there. Eakle stated[2] in 1922 that more than 300 good diamonds have been obtained from the placers of the Cherokee district. All were accidental finds in the course of washing the gold-bearing gravel. The source of these diamonds has not been found. The United States Diamond Mining Company prospected some ground unsuccessfully in an effort to find the stones in place some years ago. Though diamonds have been found at times at placer mines in seven other counties, the number found at Cherokee has evidently exceeded all the others combined. They weighed usually up to one carat, but some larger ones were up to two carats in weight. A good many were 'off color.'

GOLD (QUARTZ MINES)

The quartz mines of the Forbestown district and of Big Bend Mountain, which have been the most important so far found in the county, occur in greenstone mapped geologically as amphibolite schist, comprising rocks principally of basic igneous character, which have been dynamically altered, changing largely to schists. The influence of the great granodiorite and granite batholith lying between these two districts, and which is bordered by other scattered mines, was probably important in the genesis of the ores, though no important mines have been found here in the granite.

The bedrock formations in the entire western half, and more, of the county are covered, except where reached by erosion, so little can be judged of their character. From observations made by the writer in several drift mine workings, and in the canyons of some of the

[1] Cal. State Min. Bur. R. XI, p. 166.
[2] Cal. State Min. Bur. Bull. 91, p. 8.

streams, it appears that the slates and schists of the Calaveras (Carboniferous) series with accompanying basic dikes and serpentine follow their normal strike northwest, with dip to the northeast, across the Magalia and neighboring ridges, and that the Mariposa (Jurassic) slate occurs to the southwest of that series. The identification of these rocks, as far as it went, was made solely on the striking similarity, lithologically, of the rocks found here to those of these series in the Mother Lode counties. Gold-bearing stringers and pocket deposits in these rocks have furnished the gold which has enriched the old stream channels crossing them. This is certain because all but one or two of these channels now being worked as drift mines carry little rock except greenstone, slate and serpentine, and these channels are nearly all manifestly too small and too short to have reached back into the granite forming the core of the mountains from the vicinity of Stirling City northward. The term 'dike' has been applied to several of these gold-bearing rock series whose courses can be traced at intervals, where the removal of the lava cover reveals them. The channels, flowing southwest, offer interesting evidence of earth movements along the dikes. Nearly every drift mine that has been opened between West Branch of Feather River and Big Chico Creek shows faults that have occurred since the deposition of the gravel, where the channels cross the 'dikes.' In all cases mentioned except one, there is an apparent upthrow on the downstream (southwest) side or a downthrow on the northeast amounting to a displacement of from a few feet to 225 feet, the latter observed at the Black Diamond and Dix Mines (which see).

Associated with the Calaveras and allied rocks are many large quartz veins, which must be in the main 'spotted,' barren or low grade, as no mines of importance have been developed in them in the Magalia or nearby districts. They resemble, and are probably the same in origin as the 'bull quartz' veins of the Mother Lode.

One thing distinguished the quartz mines of the county from those farther south. In Butte County the gold is mostly in the sulphides, and little has been recovered by amalgamation, in the principal mines. A large quartz vein showing little sulphide is apt to be very low grade. Copper sulphides are usually present in small amount. There has been a tendency for sulphides to occur in bunches, rather than scattered through the quartz evenly.

Berry Creek Mine containing 80 acres in the E½ of E½ of Sec. 28, T. 21 N., R. 5 E., on the Oroville-Quincy highway. Berry Creek station on the Western Pacific Railway is about four miles northwest by road. Elevation, 1900 feet.

The property was worked by C. J. Willett et al., and later by John Kinkaid, and ore was crushed in a 1-stamp mill. It was worked by open cut and a series of short adits on the steep mountain side above (east) of the road, previous to 1910. The present owner, Carl Johnson, Oroville (star route), has driven a new adit 100 feet lower than the lowest old work and this is 175 feet long, with the face in hard granodiorite and with an estimated distance of about 100 feet to go to be directly below the point where pay was found in the adit from the road level. The old workings are caved and inaccessible, and statements as to the size of the vein are conflicting. The ore is variously stated to be from a few inches to five feet wide. It was good grade, several

hundred tons yielding a reported average value of $10 a ton on the plates under obviously wasteful milling, with high loss in the tailing; besides this, bunches of rich pocket ore yielded many thousands of dollars. The total output is estimated at from $30,000 to $80,000.

Beginning at the highest workings, there is first an open cut 65 feet long. Seventy feet lower an adit was run, a stope was worked and a drift advanced on the vein from which ore was being taken when the drift was lost by caving from the stope. A winze 20 feet below this level is said to be in pay ore. The adit from the road level is reported to be 200 feet long, with pay ore in a cross vein 15 to 20 feet back from the 2-foot vein which was struck about 70 feet from the portal.

Besides the narrower pay vein which strikes northwest and dips southwest, a wide vein of quartz striking N. 25° E. and dipping east, outcrops on the hillside east of the road. It has been prospected only for pockets. The surface of the hillside pans small quantities of free gold in many places.

Equipment consists of 1-drill compressor, jackhammer drill, gasoline engine and 1-stamp mill, the mill requiring a new building. A water ditch supplying free water crosses the property 80 feet above the lowest adit, as does also the Butte and Plumas Railroad. There are two good houses on the place.

Bloomer Hill (Chambers) Mine comprises 166⅔ acres in NE¼ Sec. 35, T. 21 N., R. 4 E., on Bloomer Hill one mile from Bloomer station on Western Pacific Railway. The railway and North Fork of Feather River cross one corner of the property. Erminie Chambers, owner, Oroville.

The deposit consists of disseminated sulphides and siliceous replacement in amphibolite schist with later oxidation, leaching and kaolinization in the upper section. The schist is derived from earlier igneous rocks, including some porphyry. The footwall of unaltered schistose porphyry strikes N. 20° W. and dips 50° E. Local jointing or movement planes may have been the lines from which the rock masses were acted upon.

The development consists of three adits, two raises and a sub-level. No. 1 adit, said to be 100 feet long and 75 feet below the surface at the face, was not visited. It is said to be all in ore. No. 2 open cut and adit crosscuts the formation for about 125 feet, N. 60° E. at an elevation of 1200 feet. Here an inspection shows mineralized schist, partly leached and kaolinized, with some cores of less mineralized rock. There are three short drifts off this level. The late A. B. Chambers, the former owner and operator, stated that ore milled from one of these averaged over $6 in free gold, and that the entire distance of this crosscut averaged $2.50 to $3 a ton. This level is 125 feet below the outcrop at the face. In this adit 40 feet from the portal, an inclined winze connects with a sub-level 120 feet deeper and with No. 3 adit 200 feet vertically below No. 2. The sub-level, about 100 feet long, shows the fresh, hard mineralized schist unaffected by leaching or kaolinization. No. 3 adit is about 600 feet long, but did not reach ore.

About 1900 the property was equipped with a 15-stamp mill and 4-drill air compressor just below No. 3 adit. Water for power and milling was brought 11 miles from Berry Creek by a ditch which cost over $35,000 and a steel pipe line which gave over 700 feet fall at the

mill. Only ore from development work had been milled when the mill and other buildings except the compressor house were destroyed by a forest fire. Several of the buildings were replaced but the mill still lies on the ground and the mine has remained idle for 12 years or more.

Burlington Prospect. Owner, Burlington Gold Mining Company, c/o Mrs. W. C. Ralston, 430 California Street, San Francisco. Comprises lots 54 and 56 in Secs. 3 and 10, T. 19 N., R. 6 E., containing 43.18 acres, near Forbestown.

A vein reported to be six feet wide has been prospected by the Joe adit, 635 feet long, which gives 170 feet of backs at the face. Some ore is reported in this. The Annette adit, about 300 feet long, did not develop ore. This property has been idle a number of years.

Carlisle Mine covers 600 acres, patented, and 40 acres unpatented, all in Sec. 35, T. 20 N., R. 6 E., one to two miles north of Forbestown. Owners, heirs of Mrs. Rose H. Hazelton, and Wm. Denman, San Francisco.

The Carlisle, Big Betsy and Indian Gulch veins occur here. The formations are granodiorite and amphibolite schist, the contact crossing the section almost diagonally in a northeasterly direction. The South Fork of Feather River has cut a deep canyon across the south half making conditions favorable for prospecting the Carlisle vein by adits. Carlisle vein has been developed by a winze 200 feet deep with three drifts 100 to 110 feet long northeast and one 315 feet long southwest on the vein, opening it for a total length of 425 feet on the 200-foot level. The vein dips 60° northwest. The adit from which the winze was sunk is on the north bank near the river level, and the drift southwest was carried under the river. The vein is reported six to eight feet wide.

A 10-stamp mill was placed on the south bank of the river and connected with the Carlisle workings by tramway, and ore from a small stope above the adit level, as well as that from development, was milled. The ore carries pyrite, galena and copper sulphides in considerable quantity.

The Big Betsy vein strikes east across the extreme northwest part of the property. It showed a reported width of 12 feet where cut in an adit 300 feet long. There is no record of ore milled from it.

The Indian Gulch vein is on the east side of the property. Ninety tons of ore from it is said to have plated $10 a ton. It is about four feet wide and only slightly developed.

Water from the river and from Forbes Ravine might be utilized. Three miles of road would be needed to connect with a road from Enterprise.

Daisy Prospect comprises two claims in SE¼ Sec. 4, T. 21 N., R. 6 E., one mile east of Mountain House at an elevation of 3750 feet. Howard Silsbee and O. G. Thomas, owners, are running an adit to cut a pocket shoot formerly mined in a shaft a little higher. The small veins and stringers of quartz occur at the surface in red and yellow ocher derived from black slate and mica schist, the entire mass of which appears to be out of place as the laminae strike east.

Another vein shows a width up to one foot where it has been trenched for 100 feet northwest. It shows some patches of coarse pyrite which

in this region distinguishes the ore veins from those of less value. A depth of only 10 feet has been reached on this vein and there has been no production.

Denver Mine. Charles L. Falk, owner, Woodleaf. Leased to E. LeG. Reeves of Clipper Mills and Gil Peyton. It is in the W½ of Sec. 4, T. 19 N., R. 6 E. The lessees are doing some work.

Evening Star Claim is in SE¼ Sec. 8, T. 21 N., R. 5 E., presumably on the south extension of Pinkston vein, 9.5 miles from old Yankee Hill. Elevation 2680 feet (aneroid). John Wells, Yankee Hill, owner. The Western Pacific Railway is about one mile distant down the steep canyon, but with no road to it. The vein outcrop strikes N. 30° W.

An adit 120 feet long follows the vein on strike. The deposit is essentially an altered zone of amphibolite schist, mineralized with thickly disseminated pyrite, zincblende and copper sulphides, and leached by descending water near the surface, with some small crusts of azurite and malachite. At 50 feet in the adit, a width of six feet is said to carry $4 to $5 free gold. A winze sunk 12 feet in the adit floor 50 feet from the portal shows an 8-inch vein of heavy sulphide carrying from 6.62% to 13% copper, 1 to 5 oz. silver, 80 cents gold and some zinc. In the adit and crosscuts a width of 50 feet or more is leached and altered to a soft mass of clay and silica.

Water can be had one-half mile distant and 400 feet lower. There is no equipment.

Florence Prospect. Howard Silsbee, owner, Mountain House via Berry Creek. There are two claims, 40 acres, in Sec. 4, T. 21 N., R. 6 E., one-half mile north of Mountain House.

Three veins of quartz carrying coarse pyrite, strike north in a width of 130 feet. The Rose Quartz or westernmost vein is unprospected as it does not outcrop but was struck accidentally in a hole, where it is said to 'pan.' The Middle or West vein prospects where side stringers make into it. This vein is four feet wide and has been prospected by a shallow tunnel and a shaft 50 feet deep which cuts through it at 14 feet. It dips 80° west. The East vein, nine feet wide, is said to be traceable for one-half mile.

The owner has run a crosscut adit 162 feet to prospect the three veins. He estimates he has 25 feet to go to reach the Rose Quartz, 85 feet to the West and 155 feet to the East vein. Work will be continued during the present year.

Forbestown Consolidated Gold Mines. M. J. Cooney and F. G. Stoer, Forbestown, owners. This group includes the Gold Bank Mine of four quartz claims and a millsite in NW¼ Sec. 11 and SW¼ Sec. 2; Golden Queen, two quartz claims adjoining Gold Bank on west, on the same vein; Golden King claim, adjoining; all of section one and N½ of NW¼ of Sec. 12; Oroville No. 1 and No. 2 placers; Shakespeare Mine (three quartz claims lying mostly in Yuba County), E½ of Sec. 10, and Miller Mine in Sec. 15 (Yuba County), all in T. 19 N., R. 6 E., and making a total of 1035 acres patented land with other unpatented claims, all near Forbestown.

Because of the past record of the Gold Bank and the possibilities of the different units of the property, it is probably the most interesting and important quartz mining group in the county.

The country rock has been mapped as amphibolite schist, a group name adopted to include a number of ancient igneous rocks which have been in the main altered by dynamic metamorphism. The rock forming the hanging wall of the Gold Bank vein is a hard, dense, fine-grained, dark-green diorite, and blocky rather than schistose. The footwall country rock is syenitic. A large granite batholith lies one mile north, and gabbrodiorite one mile south.

The *Gold Bank Mine* had been worked previous to 1887, and in 1888 a Huntington mill was in operation, but the principal activity was from 1888 to 1904. In 1890 four 5-foot Huntington mills were in use and the sulphides were being worked by chlorination after being roasted in a reverberatory furnace. Later, stamps were substituted for crushing but chlorination was used throughout the period of operation. Forty stamps were in service for ten years, when 20 more were added, and all 60 were run for six years longer.

The earlier operations were through adits and an inclined shaft on the vein. The Gold Bank and Golden Queen claims are on the south side of the canyon of South Fork of Feather River. The vein strikes about east and has an average dip of 35° north, so that the original operators could have greatly increased their net profits by taking advantage of the topography, driving a lower adit and putting the mill below the adit portal. This adit was finally driven but the mill was left above, requiring hoisting of ore. The adit, at an elevation of 1800 feet (altimeter) is 8 by 8 feet in cross section in hard diorite requiring no timber, running southwest and cutting the fissure 1275 feet from the portal. At this point, raising on the vein connected the bottom of the shaft with adit, the inclined depth being 1600 feet on dip at adit. From this connection the adit was continued to a total length of 2500 feet without cutting other veins of apparent importance. Nine levels in all were run between the shaft collar and drain adit, besides which five earlier adits had been driven on the east slope, so that the vein was stoped for an inclined depth of 1850 feet on dip. The third and seventh levels, about 1100 feet in length, were the farthest east, and third level was run 1200 feet west, making a total length of about 2300 feet explored on the strike but at only a shallow depth. The largest stope on the Gold Bank (on east side of shaft) was about 450 feet on the strike by 600 feet on the dip. The stoped width where the workings could be seen by the writer in the Gold Bank between levels eight and nine varied from 3 to 11 feet. The ore formed in lenses on both walls; in places both in the Gold Bank and Golden Queen, a lens may be seen on the hanging wall overlapping one on the footwall side of fissure, which may be as wide as 40 feet. The horses of rock between the lenses is apparently the only waste handled in stoping.

The shaft gave access to the *Golden Queen* on the west and this property was worked from 300 level to surface, largely under lease as separate owners had the two mines at the time. Here the stoping was on the hangingwall side and it is said the footwall lenses have not been mined. Where seen on the 300-foot level a footwall lens has a width up to eight feet. There is a possibility of opening up a large block of ore on this side of the mine by extending the levels below No. 3 westward into the Golden Queen. There are also possibilities of opening up more ore on the footwall on the Gold Bank, and the

possibility that the lower levels may not be exhausted. Practically no stoping was done on the Golden Queen below the 300-foot level, nor below the ninth level in the Gold Bank.

There is no full and authentic record of the production of either property. The total output of the Gold Bank is placed at $2,000,000, of which $500,000 was profit. The record of the Golden Queen when operated under lease by the Stow family, owners of the Gold Bank, from October, 1896, to October, 1898, showed 79,689 tons milled which yielded $372,565, according to figures furnished by M. J. Cooney, or a net recovery of $4.67 a ton, from which 25% royalty was paid, and a total profit of $132,334 was realized (including royalty). It is said that part of the cost of advancing the lowest adit was also charged. It is reasonable to suppose that the Gold Bank ore was of somewhat similar grade; it was mined and milled for $2.50 a ton (in 1893–1894) exclusive of chlorination of sulphides which cost $7 a ton.

The ore is solid white quartz, with subordinate ribbon structure near the walls. The free gold content is said to be about $1.50 a ton and the sulphides forming 2 to 7% of ore carry the balance, with silver, copper and it is claimed some telluride. The value of sulphide concentrate (principally pyrite with a little copper sulphide, in specimens seen) varied; in 1890 it was reported[1] to be 7% of ore and to carry $85 gold and 9½ ounces silver per ton, and in 1894[2] it was 2% to 3% of ore, yielding $40 per ton in silver and $20 per ton in gold. Elsewhere it is said to be $150 a ton. The sulphide is erratically distributed in bunches, so that hand sampling is apt to give spotty results. A little cement copper was saved. The percentage of recovery was said to have been low in early operations but later was claimed to be 92% to 95% of gold and up to 83% silver. The output of 40 stamps in 1896 was 4300 tons a month and 105 men were employed.

The last work done on the Gold Bank was in 1916, when A. I. Eagle produced about $20,000, shipping concentrate to a smelter and cyaniding slimes.

M. J. Cooney has formulated a plan for opening and working the Shakespeare and later the Miller by extending the lowest adit in the Gold Bank southwestward where he expects the Shakespeare vein would be encountered and could be followed on its strike southwest, prospecting the Shakespeare and Miller groups of claims at a vertical depth of from 1000 to 1760 feet. This adit would also offer means of prospecting other veins in the vicinity.

The *Shakespeare Mine,* first worked in the eighties, was operated a short time about 1892 by Hobart and Lane who installed a 20-stamp mill and reduction plant. A shaft was sunk 230 feet and two levels were run. No. 2 level, the longer and deeper, was carried 350 feet north and about 600 feet south, the latter connecting with a pump incline sunk a short distance from the surface. From a stope carried up from No. 2 level north for a length of about 300 feet, it is stated that $137,000 was produced, but original records of tonnage and value are not available. The ore occurred in a lens, but in the stope was mixed with low grade material, with a width of 40 feet between walls, and with quartz occurring in stringers. As a result, the recovery by amalgamation was about $3 a ton and concentrate value $35 a ton.

[1] Cal. State Min. Bur. R. X, p. 127.
[2] Cal. State Min. Bur. R. XII, p. 83.

The ore is reported to be 16 feet wide and of better grade than above, in a winze sunk 65 feet below No. 2 level, 250 feet north of the shaft. The shaft sump is also said to show six feet of quartz.

On the No. 2 level south the vein split after being followed 150 feet, and aside from the drift run to connect with the pump shaft little was done on that side, where the face has little depth, due to slope of the surface.

The ore in part resembled that of the Gold Bank, but in running No. 2 level north the ore began to show considerable galena, with high silver content.

The *Miller Mine* was prospected to a depth of 250 feet by a shaft sunk close to the junction of the Miller and supposed Shakespeare veins. From this shaft the Miller vein was drifted 250 feet and the Shakespeare 370 feet. The ore was reported as carrying about $3 a ton, and apparently there was little production from the 20-stamp mill.

Section one has been prospected only to shallow depth by pocket hunters and 'snipers.' A quartz vein there is reported eight feet wide and carries copper sulphide and free gold as well as the usual pyrite. It is locally considered a good prospect.

The old buildings and equipment on the Gold Bank have been idle and neglected many years and would have to be largely replaced. The portal of the lowest adit is near the confluence of two ravines and the water from these and from the tunnel could be utilized below on the slope for milling.

Glory Hole Mine adjoins Bloomer Hill Mine. It was a pocket producer up to a few years ago but is idle now. Pockets were mined in a glory hole, and later by shaft and tunnel.

Gold Mountain Mine. J. B. O'Sullivan, Los Angeles, and E. L. Bacon, owners. Patrick Carton, lessee, Inskip. Comprises two quartz and six placer claims covering entire NW¼ Sec. 28, T. 25 N., R. 4 E., one-half mile northeast of Inskip.

The quartz claims were worked by a company and some production made with a 10-stamp mill 15 years ago. At that time an adit was run 720 feet. Carton began work in the spring of 1928. Four men were employed June 12, when an incline being sunk on a vein 3 to 8 inches wide was down 35 feet. About 150 feet east a shaft was sunk 45 feet, and on the dump here is perhaps 20 tons of quartz stained black and from a vein about one foot wide. The walls are a complex of rotten slaty schist, dikes and soapstone. A large vein runs northeast and if the small one continues to it, pockets may occur at the junction.

Carton was installing a 10-stamp Straub mill in June, to crush the quartz and stringers in the wall rock which occasionally carry pockets.

I. X. L. Quartz Prospect is in NW¼ Sec. 20, T. 22 N., R. 4 E., on east side of the West Branch of Feather River. Elevation 1500 feet.

A vein 18 inches to 4 feet wide has been prospected in adits 120 feet and 250 feet long, 60 feet apart vertically, and in a shaft 80 feet deep, but higher on the slope. Thirty tons of selected ore is reported to have plated $14 a ton, but a later general sampling returned only $4.11 a ton, according to Sidney Wellington. A vertical range of 150 feet was prospected, and a length of several hundred feet, by the workings.

Lewis Mine comprises three claims in Secs. 2 and 11, T. 19 N., R. 6 E., containing 60 acres, one mile by road east of Forbestown. Harriet Lewis, owner. Elliott Check, Warren Brayton and associates have been prospecting the claims for about a year.

Development work consists of a series of tunnels and raises connecting with the surface, and a few small stopes. The lowest and principal tunnel is one 1038 feet long running about S. 20° W. at a depth of 395 feet below the surface on the dip at the face. This followed a vein generally 15 inches to 18 inches wide in lenticular form. A small stope near the portal yielded ore which is stated by Check to have plated $8 a ton in former operations. Near the face a raise of 220 feet on vein, and a small stope, connect with an upper crosscut level 400 feet long, near the face of which some small stopes were opened, and connections made with the surface. The distribution of ore is said to be spotted, in an ore zone pitching north. The recent work has not developed enough ore, according to Check, to offer much encouragement. Stopes are about 40 by 30 feet, and up to two feet in thickness of ore was mined.

There is a mill of five small stamps, a rockbreaker and one concentrator. Water power was used formerly, but recently an automobile engine has been substituted for it at a great reduction in cost, as water rates are high. Four men were employed in July.

Mathewson Mine, now a part of the Springer Consolidated (which see) is on a so-called dike, which in reality is a series of formations corresponding in all respects to the Calaveras (Carboniferous) and associated rocks of the Mother Lode counties, of which it is a continuation on the strike northwest.

The hangingwall of the series is of serpentine, and going across in section to the footwall, the rocks are: Solid 'bull' quartz vein, two feet wide; rusty red-brown decomposed dike rock, with quartz stringers; rotten schist; Calaveras slates, schists, siliceous rocks, 200–300 feet wide. While the entire series is said to carry a little gold, the best pay is reported where stringers from the Calaveras formation intersected cross-faults. Mathewson ran a hydraulic cut for 800 feet along the strike on the hangingwall side, and another cut was made on the footwall side, indicating a total width 600 feet. A $1,500,000 production was claimed. He also operated an 8-stamp mill for a time on a quartz vein exposed by the placer mining.

McClung Prospect comprises two claims on a quartz vein reported to be 4 to 30 feet wide and traceable a long way, on Wild Yankee Creek, a mile south of east of Berry Creek station. C. J. Willett, Harts Mills, ran two adits here 25 years ago. One was 200 feet long on the vein, which assayed $1.50 to $12. This is caved now. The other was a crosscut 110 feet long crossing through the vein, which is said to have a high sulphide content. J. McClung, Harts Mills, has lately relocated the claims.

McHugh Prospect is in SE¼ of SW¼ of Sec. 36, T. 24 N., R. 3 E., adjoining the old Toadtown Mine. P. J. McHugh, Dave Campbell, A. L. Donnelly and others have sunk a prospect shaft which was 18 feet deep on July 22, and was on a vein said to prospect well. There is a small pump run by a gasoline engine to keep the shaft unwatered.

Pinkston Mine is one claim in NE¼ Sec. 8, T. 21 N., R. 5 E., 9.2 miles by road from old Yankee Hill. R. L. Bohannan, owner, Yankee Hill. Elevation 2500–3000 feet.

Pinkston first worked the property about 1890–1895 through an adit 100 feet long about 50 feet below the outcrop. The red oxidized ore was stoped 12 feet wide and 60 feet long, and is reported to have plated $8 to $9 a ton, and to have produced $16,000 with a mill of five small stamps. Work ended when sulphide ore came in. An unusual feature was the occurrence of barytes as a gangue mineral. It is too impure to be of commercial value, however, where seen in the old working.

A new adit has been run perhaps 100 feet lower, in a southerly direction for 110 feet. The formation is amphibolite schist, with schistosity striking N. 30° W. at the face. There a width of 20 feet or more revealed by the diagonal course of the adit, is impregnated with pyrite and small amounts of copper sulphides and zincblende. A number of assays indicated $2.50 to $3 a ton gold, according to John Wells.

Porter Mine is in Secs. 17 and 20, T. 22 N., R. 4 E., 7 miles north of Yankee Hill via Jordan Hill road. Sidney Wellington, owner, 321 Montgomery Street, Oroville. Elevation 1740–1900 feet.

It was first worked in the early fifties. A vein of solid quartz, in part brecciated and recemented by brownish silica, is six feet wide and strikes north, dipping 75° east. A large part of it has been worked to a depth of 10 feet for a length of 300 feet and the quartz crushed in arrastres. Porter made some production also previous to 1870. Later an English company and then W. T. Coleman prospected the vein, but there is no record of production by them. An incline shaft is at least over 140 feet deep on the vein besides which several adits were run, one 140 feet below the outcrop. There is no equipment.

Rainbow Mine. Millen Griffith Estate, owner, San Francisco. In SW¼ Sec. 29, T. 22 N., R. 4 E., six miles northwest of Yankee Hill on Jordan Hill road.

This mine was discovered on railroad land in 1889 by Wellington who lost it in a lawsuit after producing $9,000. It was later worked until December, 1893, and produced probably $40,000 according to Wellington. A 5-stamp steam power mill was used.

An inclined shaft was sunk 350 feet on a quartz vein averaging two feet wide, and ore was stoped from three levels from 250 feet deep to the surface. The ore was of good grade, averaging $25 a ton, and being very rich in places, above the 250-foot level, but poor in the bottom of shaft. The vein strikes northeast and is crossed by a dike at the millsite. The old 5-stamp mill lies on the ground.

Silver Moon Group (formerly *Porphyry Point*) is in S½ of NW¼ of Sec. 18, T. 23 N., R. 4 E., and contains about 32 acres. H. Bartram, Coutolenc, owner. Property is on a good road and one-fourth mile from railroad. It covers a dike deposit and a quartz lode in decomposed dolomitic talc-schist. In the latter, quartz veins occur on both walls of a light gray dike two feet wide with pyrite in coarse cubes. It strikes north and dips east. The quartz is eight inches wide on the hangingwall and 3½ feet wide on the footwall. It carries pyrite in patches, and small amounts of chalcopyrite, but only a few shallow cuts have been

made on it. It is probably low grade. A similar deposit, perhaps the same vein, occurs at the old Perschbaker workings.

The dike deposit is of interest geologically and for its mining possibilities. It is so thoroughly decomposed that it is of sandy nature, colored red and yellow, and with seams of quartz up to an inch wide, stained by manganese and carrying gold. Lenses and bunches of rotten dolomitic schist stained by mariposite and thickly pitted with iron oxide derived from pyrite, probably are residual fragments of the original rock from which the deposit came. There are some patches of partly altered slate also. Serpentine runs parallel on the footwall side. The dike strikes northwest and the exposed lens-shaped body, mostly included in this claim, is 1800 feet long by about 800 feet wide. To the southeast it is covered by a run of lava cobbles, supposedly underlain by a gravel channel.

Some of the deposit has been worked by ground-sluicing in years past and Bartram has mined a little of it with a drag-line scraper. This outfit, operated by a 15-hp. gasoline engine, has a three-fourths cubic yard bucket and can handle 150 cubic yards in eight hours under favorable conditions. On account of the loss of gold in the coarse quartz which goes out of the sluice in the course of ordinary washing, he plans to install a screen to save the quartz and an arrastre or small mill to crush it. The deposit is susceptible of very cheap operation by the method planned and should yield a profit so long as that method can be followed.

Southern Cross Mine is in SE¼ Sec. 32, T. 20 N., R. 6 E., about four miles northeast of Enterprise by road and trail, adjacent to South Fork of Feather River. Owner, Edel Mines Company, I. L. Rosenthal, president, 177 Post Street, San Francisco.

The lower adit, about 1800 feet long, enters from the east bank of the river on the southwest end of the Southern Cross claim and runs on the vein through that claim and the Manzanita fractional claim into the Manzanita Extension. The vein strikes southwest and dips northwest in granodiorite. Three small stopes of ore have been mined; one near the portal and one midway in the adit have been carried to the surface, and another near the face has been worked to a height of about 100 feet. Two winzes, each about 75 feet deep, have been sunk below the main adit in the latter two orebodies, the first showing the vein seven feet wide and the second, four feet wide. From the inner winze, lower drifts have been run 105 feet and 95 feet, respectively. Apparently only parts of the orebodies have been stoped above the lower adit. Ore is said to have averaged $8 a ton, with some bunches of higher grade, and high grade concentrate. An upper adit 700 feet long is connected with the lower.

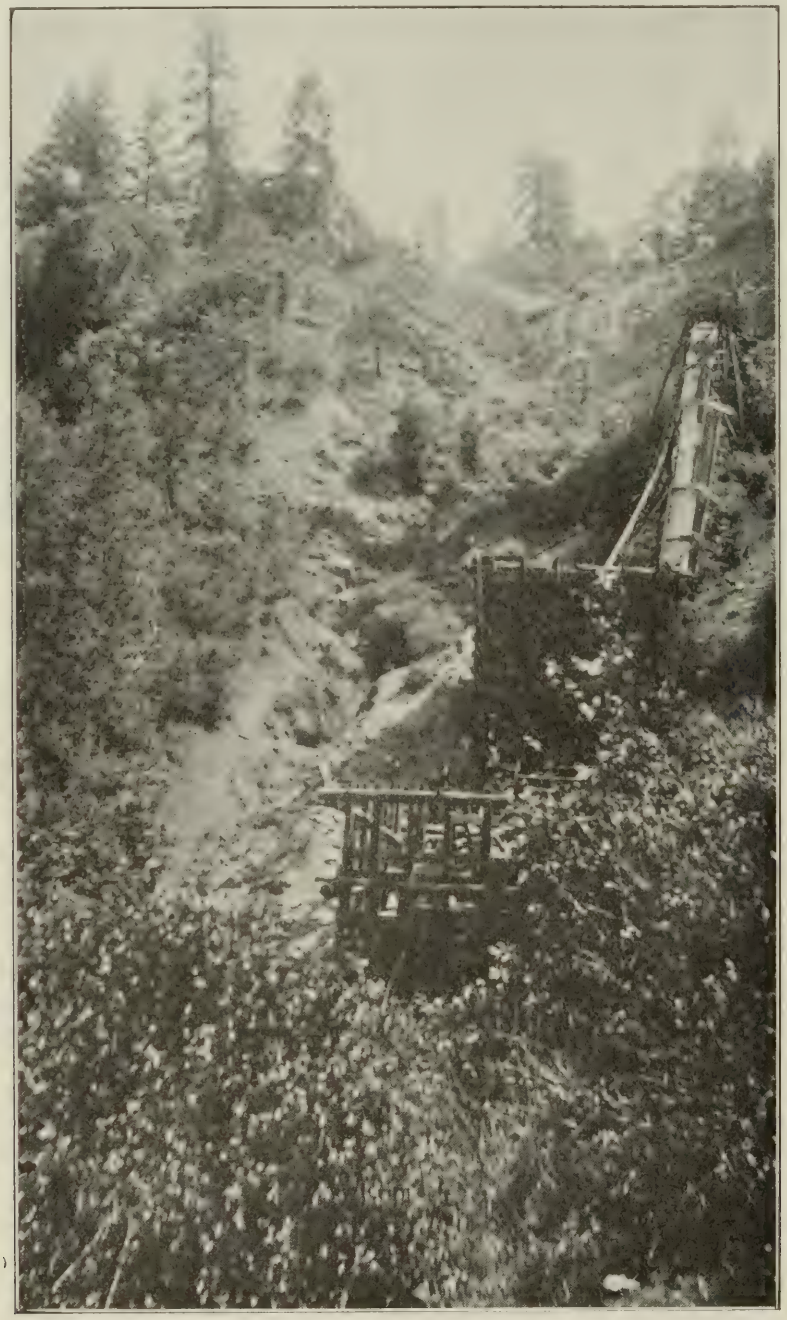
On the opposite side of the river on same level as the lower adit, an adit runs southwest 400 feet, with a winze 50 feet deep about midway of it, and 30 feet of drifting from the bottom of winze is claimed to be in ore three feet wide.

There is an old mill of four stamps, a ball mill, and old concentrator on the property.

Springer Consolidated Mine. Owner, Springer Consolidated Mining Company, Box CC, Tonopah, Nevada. This comprises the Springer Mine, Mathewson Mine and a mill site, in all about 45 acres in E½

Sec. 34, T. 24 N., R. 3 E., 6.8 miles by good road from Magalia, the nearest railroad station. Other unpatented claims were formerly held.

The Springer and Mathewson claims, respectively, were worked by ground sluicing and hydraulicking for many years by their then owners, Springer and Mathewson. The Mathewson claim yielded a large sum. It is separately described herein. The Springer, worked



Springer Consolidated property near De Sabla, showing formations that were mined by steam shovel.

on a smaller scale, paid a living to its owner, and undetermined amounts to wandering pocket hunters who worked small seams known to carry coarse crystallized gold. The deposit (described under Mathewson), is a belt striking northwest and dipping northeast, composed of serpentine, Calaveras (Carboniferous) schist and slate and associated altered and mineralized rocks, all carrying gold in small quantity but with

the best pay where seams and stringers in the Calaveras rocks encounter cross faults.

The company in 1915–1917 installed a plant for large-scale operation, spending over $100,000. An open cut was started on the Springer. This is about 300 by 150 by 90 feet. Rock was churn-drilled and blasted and moved with a steam shovel into chutes delivering to bins. Five ball mills were used for grinding ore and Deister tables for concentrating after amalgamating. It is said a capacity of about 700 tons a day was reached and that work continued over a period of five months. Operations were terminated through the action of the Fish and Game Commission of California and the federal government, who objected to the dumping of tailing into Butte Creek. The property has lain idle since the early part of 1917. When the company started work, they stated the average value per ton milled was expected to be about $1, with a cost of fifty cents a ton for mining and milling. The yield per ton came very close to the estimate, according to John G. Kirchen, general manager, and he believes the project would have been a success had it been allowed to continue.

St. Francis Mine. P. J. Hurley, Planters Hotel, San Francisco, owner. Claims in Secs. 28, 29 and 32, T. 20 N., R. 6 E., north of Feather River and three miles northeast of Enterprise. It was reported in June that workings which were left in 1924, after a fire, were to be reopened and sampled with the idea of forming a stock company.

Surcease Mine is in the N½ of Sec. 7 and adjoining parts of Secs. 5 and 6, T. 21 N., R. 5 E., 7 miles by road from old Yankee Hill. Berry Creek and Las Plumas on the Western Pacific Railway are each about 2 miles distant in the steep canyon but there is no road connection.

The mine was found on patented railroad land in Sec. 7 by M. P. Kinkaid and was purchased and operated by him and a partner in 1914–1916. In shallow workings near the surface, he is reported to have produced $17,000 from ore that yielded $7 a ton in free gold, with nearly as much in the sulphides. A 1-stamp mill and a Chilean mill were used. The holdings were taken over later by Goldfield Consolidated Mines and Exploration Company and other adjoining land acquired. After prospecting the mine, bottoming the ore and blocking it out, they decided it was too small for the scale of operations desired. The Gruss Mining Company later took a lease and option on it, but were unable to successfully operate it. After a period of idleness, Marc Latham and Gobel leased the mine on royalty and operated it at a profit from 1924 to 1927. J. W. Reno and associates later made some production and George P. Brennan and others were preparing to mine more ore in June, 1928. The total production has been over $200,000 to date. The larger part of ore mined averaged $9 a ton; some was much better, yielding $12 a ton or more.

The country rock is amphibolite schist but a granitic batholith is exposed only two miles southeast. The vein strikes northwest, with the principal ore shoot pitching N. 18° E., being bounded by a fault. The north ore shoot which yielded most of the gold, extended from near the surface to the 210-foot adit level where it appeared to be definitely bottomed as a lower sub-level run by Latham, failed to strike it. This ore shoot was 132 feet in average stope length and 6 feet in average thickness though at times much wider. The vein in the shoot was of

solid quartz with subordinate ribbon structure and variable but rather high content of coarse pyrite in patches, carrying a small amount of copper sulphides. Latham reported nearly all the gold was in the sulphides, and quartz with little or no sulphide was low-grade. The south ore shoot apexed about the 210-foot adit level, had a pitch length of about 140 feet and a stope length averaging 110 feet. It also has been bottomed, to judge by results of work below it.

The shaft, 610 feet deep, is on an incline of 24° to a depth of 450 feet, there steepening to 40° the rest of the way. It passed diagonally across the fault block containing the two ore shoots. The principal working level was the 210-foot adit, entering from Shields Gulch near the mill and running northwest on the vein 1000 feet or more, crossing the shaft and extending to the north fault. A level above it was run 420 feet southeast and 560 feet northwest and beyond north fault. Below the adit, a level was run both ways and raises put up to prospect for the downward extensions of both ore shoots which did not materialize. The 600-foot level was also run 450 feet southeast and 600 feet northwest giving some good assays but not finding any orebody.

Latham found the ore well adapted to cyanidation. It was ground to minus 30 mesh in a 4-foot by 3-foot ball mill and all cyanided. His operating cost for mining, milling, treatment and marketing bullion was $5.03 a ton. The plant had a capacity of 45 tons in 24 hours, and about 27,000 tons were treated.

Since Latham quit work here, the plant has been changed, first to combined concentrating and cyaniding and now to concentrating, it being planned to ship out concentrates. Equipment in May, 1928, included two 4-foot by 3-foot Hendy ball mills, one Overstrom concentrator, Dorr classifier and 7-inch by 9-inch crusher. An air compressor was to be installed. Electric power is used. A few thousand tons of ore remain in sight to be worked.

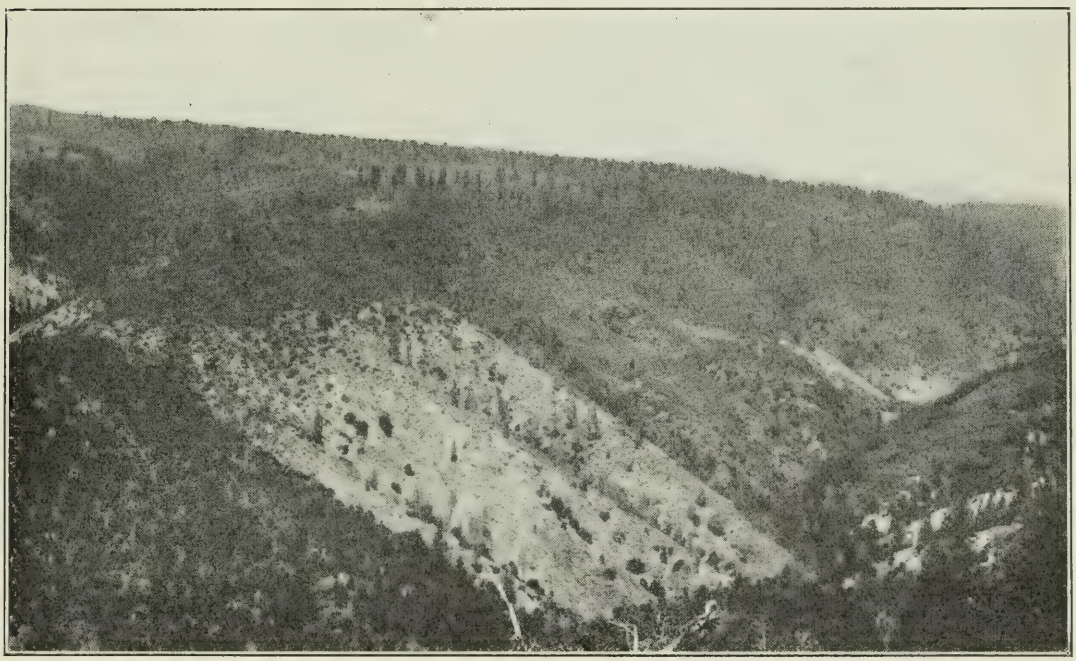
Triumph Mine. Owner, Triumph Gold Mining Corporation, 403 Van Nuys Building, Los Angeles. Five claims, containing about 90 acres, are in S½ Sec. 15 and N½ Sec. 22, T. 20 N., R. 7 E., three miles southeast of Lumpkin.

Heretofore, a blanket vein has been worked, which yielded free gold without sulphides on account of the nearness to surface. The mine is on the north side of canyon of South Fork of Feather River, and is opened by adits. No. 3 adit, 900 feet vertically above the river, is connected with No. 2 adit, over 100 feet higher, by a raise which strikes No. 2 about 200 feet from the portal. The property was not visited. It is reported that the vein was found in an intermediate level between No. 2 and No. 3 adits during the past year, having apparently straightened up to a dip of 70° between definite walls. It is at a contact of granodiorite and 'diorite' where a branch of a granitic batholith intrudes amphibolite. The vein is from 18 inches up in width.

The prospects developed led to the erection of a new mill of five 1250-pound stamps, which was completed in January, 1928. This has 100 square feet of outside amalagamating plates but no concentrator. A free water supply is taken by two miles of ditch from Knownothing Creek and Devils Ravine. The stamps and rock breaker are operated by separate water power wheels. A few men are employed.

GOLD (PLACER MINES)

From the earliest days of gold mining in the state, Butte County has been known as a producer of placer gold. The drift mines which were opened after the exhaustion of the surface placers have proved to be mostly on small channels but a few of them, notably the Emma, Indian Springs and Perschbaker, were rich producers over a long period of years. In the main, however, these mines give employment to only a few men each, and there is such a large number of them in the county that are or have lately been active that a much longer period than expected had to be spent in the field in order to bring the division's records to date. The principal drift mining section is bounded on the east by the West Branch of Feather River, on the west by Big Chico Creek, and extends from the vicinity of Centerville and Paradise on the south, in a direction a little east of north to the top of the mountain divide in the northeast corner of the county, where the waters of the



Cañon of Little Butte Creek, Butte County, from Lucky John Mine. The inlets and outlets of several paying drift mines were found in this trench.

West Branch are separated from those of the North Fork of Feather River by summits about 6600 feet high. The streams in this section flow south and southwest, cutting the lava-covered slope into a series of long ridges beneath which are found a multitude of steep, narrow gold-bearing ancient stream channels. None of these so far exploited compare in size or characteristics with the large ancient rivers of the counties farther northeast and southeast, although larger channels have been mined farther southeast in Butte County at Bangor and Cherokee.

The Ione shore line extends northwest, bounding the drift mining district at Cherokee and Mineral Slide (near Paradise). From the points where the ancient streams emptied their loads into this old ocean, and where the erosive action of waves and modern streams resulted in concentration of gold under favorable conditions, southward

to Thermalito and Haselbusch, south of Oroville, there existed until about ten years ago some of the richest gold dredging fields ever found. The total area of profitably dredgable ground in the Oroville district was about 6500 acres, taking in part of Oroville townsite and extending southward along Feather River about seven miles with an average width over one mile. Besides this, there were smaller areas, as at Wymans Ravine, Honcut Creek and on Butte Creek, the latter near Chico. The dredging industry in the county reached its zenith between 1900 and 1910. In 1902 there were 35 dredges being operated by 12 companies and in 1908, there were 34 dredgers, which produced over $3,000,000, each of these years, and during the period the county was more than once the leading gold producer of the state. As shown by the analysis of placer gold production from the county (see, post) the dredger output rapidly decreased from 1916 onward. At present there is no active dredger in the county, although Lawrence Gardella is preparing to put a small boat in operation near Haselbusch. The gold dredging operations have been described at length in our past publications.[1]

Hydraulic mining, once carried on at Cherokee on a large scale, and at a few smaller mines, practically ceased in 1915 as far as recorded production is concerned. There appear to be no new data to add in this regard. Many so-called dike deposits exist which have been found to carry enough gold in the superficial oxidized and weathered zone to repay hydraulicking and ground sluicing. Numbers of these have been worked in years past. They are, properly speaking, lode mines and some are described under that head herein, but the production from many of them appears in the tabulation under 'surface' mines.

The following tabulated analysis of placer gold production from Butte County for a number of years gives an idea of the relative importance of the different branches:

Partial Analysis of Placer Gold Production, Butte County[2]

Year	Dredges		Drift Mines		Hydraulic		Surface	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
1906	15	$2,768,782	12	$102,908	5	$37,220	24	$101,207
1907	35	2,697,092	9	22,158	3	18,375	22	48,103
1908	34	3,043,151	11	13,878	1	12,736	25	56,192
1909		2,890,273						
1910	32	2,389,235	14	47,497	5	15,775	16	15,998
1911	30	2,251,764	12	22,937	4	9,152	28	27,769
1912	28	2,271,996	19	31,545	3	7,205	18	14,182
1913	25	2,122,926	12	43,894	3	4,871	14	62,092
1914	21	1,637,515		43,732		5,034		6,678
1915	17	1,491,006	5	13,746	2	5,644	8	30,910
1916	14	1,210,874	5	12,004			6	15,369
1917	11	893,141		13,984				10,490
1918	8	626,010	6	4,394			7	11,765
1919	6	361,604	4	7,130			7	6,642
1920	4	441,650	4	19,462			7	3,414
1921	4	420,017	1	3,328			8	28,805
1922	4	452,191	6	34,406			5	4,915
1923	4	398,125	8	73,727			11	19,660
1924	4		4	7,092				
1925	4							
1926	Total Placer Production 33 operators, $228,031							
1927	Total Placer Production 32 operators, $143,294							

Many placer mines in the northeastern part of the county, which are now idle, have been described in U. S. Geological Survey Professional Paper 73, pages 95 to 98. Several of these have been worked out, and

[1] Cal. State Min. Bur. R. XV; Bull. 57; Bull. 85.
[2] Abstracted from Mineral Resources of U. S., U. S. Geol. Survey.

there has not been much work done in that section in recent years, so that a full new investigation appeared unnecessary, although a number on which work is being done are mentioned herein.

Very little work has been done in late years at Bangor, where drift mines were formerly worked through shafts.

A few small placer mines, mostly surface sluicing, are worked in winter near Clipper Mills, Hurleton and other sections in the eastern part of the county. Time was not available for visiting these.

Bader Brothers (formerly Mat Bader) *Mine* contains 160 acres in Sec. 36, T. 23 N., R. 3 E., on the east side of Little Butte Creek, one-half mile from Magalia. E. F. Woodworth, lessee, Paradise, has been prospecting the claims since November 15, 1921. The production so far has been only nominal, no regular breasting having been carried on by the present operator, but some was done previously.

The main adit runs S. 60° E. for 500 feet and the remaining 800 to 850 feet to the face (July, 1928) has a winding but generally southeast course, running from S 25° E. to S 48° E. at the face. A channel has been encountered but not bottomed. It is evidently the same run of gravel opened in the Pitts Mine, downstream. The main adit has crossed this channel diagonally in a length of 100 feet near the face, having been run from the west rim to the east rim, which was being followed late in July. Good prospects were reported on the east rim. A branch drift running S. 65° E. and 153 feet long, shows rotten porphyry boulders covered by one to two feet of granite sand, and this in turn is covered by lava sand filled with small rotten granite boulders. In holes sunk six feet below this drift near the face, bedrock and good pay gravel are reported. A pump is needed to keep out water and permit further work downstream in this direction. The elevation at the portal is 1970 feet.

At a point 900 feet from the portal a drift runs due east 50 feet and southeast 50 feet, where there is a raise 10 feet and an upper level running 150 feet southeast. Here a raise was put up 20 feet on the steep bedrock of the east rim showing large boulders and a good prospect high on the rim.

Three to five men are employed. A blower for ventilation is run by water power. Hand tools are used, but electric power is available one-fourth mile distant. Water from the workings is stored in a small reservoir for washing gravel.

Black Diamond Drift Mine is in E½ of Sec. 34, T. 24 N., R. 3 E., and contains 31.4 acres adjoining the Springer Consolidated Mine. The owners are E. N. Understock, Route A, Oroville, F. and R. Duensing and L. Mecum, Chico. Magalia, on the railroad, is 6.8 miles distant by good road.

This claim was included in holdings on which the Indian Springs Channel Gold Mining Company sank their Kirby shaft 186 feet in 1917, and did some other work without results. A gravel channel traverses the Black Diamond property and the upstream section of it is faulted downward a reported distance of 225 feet by a fault which strikes northwest along the course of the Springer and Mathewson dike. The segment of channel southwest of the dike was profitably worked, and the stub of the old adit may be seen in the old open cut

of the Mathewson Mine, which cuts across the lava-covered channel. The channel courses S. 18° W., and is reported 80 feet wide on bedrock. The lava fill at the surface is about 250 feet wide. The trough is filled with andesite mud and boulders. An upper sand run is underlain by a bench of pay gravel, with the main channel 18 feet lower.

In 1924, an inclined shaft was started by the owners just northeast of the fault and was sunk 280 feet on 40° incline. This apparently struck the southerly rim or a bench as the other rim has not yet been found. A crosscut was run 75 feet west in gravel reported to carry $2 to $3 a cubic yard in the part near bedrock. The gravel is tight, requiring drilling and blasting. No work is being done now. The claim is well equipped, having a 40-h.p. boiler, two compressors, hoist, three pumps, air fan, air drill outfit, shop and several buildings. Electric power is two miles distant.

A tunnel 800 feet long, partly on other property, would reach a point about 50 feet vertically below the shaft sump, and if water were taken down the Kirby shaft a cheap method of underground sluicing could be used.

Blue Hog Mine. Owner, Feather River Land and Mining Company, c/o D. Joseph Coyne, 407–408 Security Building, 510 South Spring Street, Los Angeles. It was last worked in 1920 under lease by Henry S. Porter with E. F. Woodworth, Paradise, in charge. This work was terminated by a lawsuit concerning the water supply needed to wash gravel.

This old mine had been worked at intervals for nearly 40 years. It covers about three-fourths of a mile of a lava capped channel containing loose gravel on slate bedrock. The pay gravel is two to five feet deep and 70 to 100 feet wide. There is a main tunnel which was reported to be 1700 feet long early in 1920 and a drain tunnel 900 feet long. Over 1000 feet of main tunnel is said to have been driven by the last operators and they mined a width of 100 feet for a distance of 400 feet upstream. The lower end of the ground is said to be rich, but a section of channel 2000 feet long is too low to be worked through the present tunnel.

The mine is supposed to have a normal supply of 800 inches of water, but this water right is in conflict with the Paradise Irrigation District. When sufficient water was available, mining was done by piping water to the breast and washing the gravel in sluices laid in the tunnel. The property is equipped with a compressor, 4200 feet of 10-inch to 2-inch pipe and 1700 feet of 14-inch by 16-inch sluice boxes.

Cherokee (Spring Valley) Placer Mine has been frequently described in past reports of the State Mining Bureau. It comprised about 1500 acres around the old camp of Cherokee. About 150 acres was hydraulicked to bedrock, with a bank 500 feet high and nearly as much was worked to within 15 feet of bedrock, the lower portion being cemented. The bottom of the channel is flat, and about 700 feet wide. Lindgren believed it was the bed of a broad, steep gulch. For many years this was one of the largest placer gold producers of the state. It had a ditch system 94 miles long, supplying 2200 miners' inches of water. During its long period of inactivity, the water rights and

ditches have been lost and abandoned, so that at present there is only about 200 inches of water believed available. For a full description of the property, the reader should consult the reports cited below. The mine was worked by hydraulicking exclusively from 1858 to October, 1890, having been previously mined in small parcels by many separate owners. The production previous to 1870 was estimated at over $5,000,000. From 1870 to July, 1886, it produced $5,008,208.62.

Bibl: Cal. State Min. Bur. R. VI, part 2, pp. 24, 25; X, p. 124; XI, p. 155; XIII, pp. 92, 93; XVIII, pp. 258, 259. U. S. Geol. Survey, Prof. Paper 73, pp. 86, 87.

Cory and Strong Placer Mine is 2.8 miles by road north of Stirling City, containing 320 acres in E½ of Sec. 16, T. 24 N., R. 4 E., on the west side of West Branch of Feather River. Cory and Strong, owners; E. L. Williams, W. H. Weimer, and Wilbur H. Mallman, lessees, Stirling City.

A large, lava-covered trough, with rims 1500 to 2000 feet apart, crosses the property. In its bottom is supposed to lie an auriferous channel locally called the Mammoth Channel. Going upstream on the West Branch about three-fourths mile from the present shaft and a little north of the property, the stream enters hard diorite or gabbro-diorite and the rim of the channel turns east; the river from here up is said to flow on such bedrock for eight miles, and here it has cut a canyon 50 feet deep in it. Going south on the road toward Stirling City, the southeast rim of rotten granitic rock and the lava fill are plainly seen in the cut just west of the road, 1.7 miles south of the shaft.

Years ago, Cory drove an adit 700 feet long about 400 feet south of the property line at an elevation of 3300 feet (aneroid). It is said to be on a secondary flow. The lessees are sinking a vertical shaft about midway of the property, and about 75 feet above the river on the west side. This was 53 feet deep when visited in June, 1928, and was being equipped with two small gasoline engines, a 6-inch pump and hoist. The depth necessary to sink to reach the channel trough is uncertain, but it seems likely that it will be considerably farther than estimated by the operators, although benches above the trough may be encountered on the way.

Dix Drift Mine is west of Big Butte Creek in Sec. 22, T. 24 N., R. 3 E., about 9 miles by road from Forest Ranch. It has been prospected during the past 7 years by a partnership, with Harry Sheehy, De Sabla, in charge. Many years ago the upstream part of the property was profitably worked.

Little West Branch of Big Butte Creek cut the Dix channel in two. The upstream part was worked for a distance of about a mile by the old Portuguese Point hydraulic and drift workings. At the upper end of this work a fault is said to have been encountered which dropped the upstream segment of channel 90 feet, and the Robison prospect lies on this segment. From the crossing of Little West Branch, the Dix channel was followed downstream 3000 feet in the old Dix Mine. Two runs of gravel, with separate rims in places, are reported there. The older channel, capped with rhyolite, is locally stated to have yielded $7 a cubic yard for a width of 30 to 60 feet. A later channel

was 'spotty.' This work also encountered a fault, believed to be the same mentioned under the Black Diamond Mine herein, where the upstream segment of channel was dropped (or downstream segment raised) 225 feet. The work was stopped there, and the operations of the present partnership have been directed to finding and working the downstream section.

The mine was temporarily idle when visited and the underground workings were not examined. The following data were furnished by Harry Sheehy:

Sheehy and associates have driven a main adit 2350 feet west (elevation at portal 2040 feet) through slate and serpentine bedrock. This struck faulted ground 1900 feet in and was continued 400 feet across a 'dike' which Sheehy identifies as the same as the one described herein under Springer Consolidated Mine. The fault is said to be on the west wall of the 'dike' at a slate-serpentine contact. Near the face a vertical raise was put up 285 feet. An upper level was turned at a point 100 feet above main adit and was run 900 feet N. 30° W., when a raise was put up and struck gravel on the east rim of channel. The upper level was then continued 400 feet farther and position of both channels was determined by several raises. The older rhyolite-capped channel, carrying boulders of granite, slate, serpentine and schist, was found intact 15 feet above the later channel, which is capped by andesite. Crosscutting showed the early channel to be 250 feet wide, and the later 200 feet wide, with a bar or bench of the later channel between. About 300 feet of channel was worked downstream from the fault with disappointing results apparently due to the spreading out of the channels and flat grade.

Work has been carried downstream about as far as can be done from the upper level, and the present plan is to advance the lower adit in the direction of the upper face and then raise again into the channel. A 2-drill compressor is operated by a Pelton water wheel, using free water under 128 feet fall, brought by ditch and pipe from Little West Branch of Butte Creek. The water supply is said to be too small for a few months in summer to permit work. There are some small dwellings on the claims.

Emma (or Nimshew) Drift Mine is in Secs. 14, 15 and 23, T. 23 N., R. 3 E., between Middle Butte and Big Butte Creeks. It has been one of the best producers of the county, with a total output of $1,000,000 or more. It was operated and is still owned by Nimshew Gold Mining Company, c/o John Erickson, 141 Sutter Street, San Francisco. George Allen has a lease and A. Rugh and R. Phillips are prospecting it. There are 590 acres in the property.

The Emma Channel, running southwest, was worked upstream for 5000 feet, and a branch called the Bootjack, which runs east, was followed 2000 feet. In the first adit a fault with a downthrow of 16 feet on the upstream side was struck 1600 feet from the portal. A new adit was run from which 3400 feet more of the channel was mined. A width of from 12 to 125 feet, but averaging not over 30 feet, was worked. The bedrock is soft, black slate, across which the channel ran at nearly right angles to the cleavage, making an ideal natural riffle, on and within the crevices of which all the pay was found. The grade was variable, being 10% in one section 1200 feet long, where no gravel lodged, and the lava rested directly on bedrock. Here six

feet of bedrock was mined as it was easier worked than the lava which made a good roof and still stands without timbers. There was much coarse gold. Where the grade flattened, there was a thickness of 4 to 5 feet of gravel. There was enough grade to permit sluicing the entire distance underground, water coming from a reservoir alone.

This channel and its branch were worked upstream at a profit until cut off by a later trough filled with barren lava cobbles and sand. One week's cleanup just before this, yielded 13¼ pounds of gold. Since then, during the past 15 years, close to 5000 feet of prospecting drifts and crosscuts have been run in search of the upstream section of the Emma channel, but all efforts so far have failed. This work is being done now through a crosscut which strikes the crossing of the pay and barren channels about 700 feet underground and at an elevation of 2145 feet (aneroid). This is about one mile north of the old portal.

Ethel Mine. Owner, Pacific Investment Company. An adit about 2700 feet long, with an incline of 80 feet 2550 feet from the portal and one of 400 feet near the face, failed to bottom the channel. A raise was made to the adjoining Index, where a bar was worked. This ground lies between Middle and Big Butte Creeks, one-half mile southwest of where the Mammoth shaft was started in search of the Mammoth channel, two miles west of Magalia. In June, 1928, new work was started at the Ethel from the west side.

Fouch Drift Prospect. Owners, F. Fouch, Chico, c/o J. A. Garland, Butte Meadows Stage; J. Fouch and W. M. Triplett. There are 160 acres in the claim.

This prospect is on the west side of ridge between Big Butte Creek and Chico Creek, in the Chico Creek drainage basin a few miles north of Forest Ranch. A rhyolite-capped channel has been prospected by adits started from a creek which crosses the channel. Going upstream, smooth, hard bedrock so far found has been reported unfavorable for a concentration of gold, though some pay has been taken out at intervals. The adits in both directions are short. There is thought to be over one-fourth mile of channel in the upstream section on the property and 500 feet downstream.

Genii Mining Company. Office, Room 549 Holbrook Building, San Francisco. The property consists of 485 acres of unprospected placer claims in S½ Sec. 19, N½ Sec. 30, T. 23 N., R. 4 E., and E½ of NE¼ Sec. 25, T. 23 N., R. 3 E., from one-half to 1½ miles north of Magalia.

The operators believe that an ancient channel, locally called the Mammoth and sometimes the Magalia channel, traverses the property. This channel was reached in the Parry or Alki incline in SE¼ Sec. 18, T. 23 N., R. 4 E., but reports are conflicting as to whether or not it was actually bottomed; it was found to contain large washed boulders and coarse granitic sand. There was a heavy flow of water. It was thought in 1890 that the channel bedrock had been reached,[1] but in 1892, the incline had been advanced 500 feet farther, "without, however, tapping the old back channel that courses north of northeast."[2]

The elevation of 'supposed bedrock' reached was 1630 feet according to Lindgren;[3] according to a map by Kay, the elevation at the collar was 1850 feet and at the bottom 1647 feet. In any event, it has

[1] Calif. State Min. Bur. R. X, p. 141.
[2] Calif. State Min. Bur. R. XI, p. 161.
[3] U. S. Geol. Survey P. P. 73, p. 92.

not been profitably worked although it might be supposed, from geological reasoning and comparison, to be gold bearing as it traverses several auriferous formations, and has eroded a longer and deeper watershed possibly than other channels that have produced well.

The company has started an adit from the west bank of West Branch of Feather River in NE¼ of Section 30. They estimate this will have to be run about 3200 feet to reach the channel. By the middle of July this had reached a distance of about 600 feet. It was planned to have it continued under contract at about $15 a foot. It is 7 by 7 feet in cross section and so far in serpentine.

The adit is 1.2 miles by new private road from the Magalia road at a point 1.1 miles north of Magalia. Electric power has been brought in over one-half mile of new line. An air compressor (14 by 12), (9 by 12), operated by 75-h.p. motor, drill sharpener, oil-fired forge, and blower have been installed and several buildings erected. Fifteen men were employed in May, but the force was reduced with the completion of surface work.

Hupp Placer property comprises 480 acres in NW¼ Sec. 1, N½ of SW¼ and N½ Sec. 2, T. 23 N., R. 3 E., a mile north and east of De Sabla. Mrs. Hupp, De Sabla, owner. G. F. Skelton, 5031 Rio Chico Way, Chico, has an option.

The Indian Springs adit was run upstream on the channel for about 700 feet on the Hupp ground, when stopped by injunction. Another channel (see Nugget) was worked by a shaft 80 feet deep and an incline from it in NW¼ of NW¼ Sec. 1, but work had to be suspended on account of water, after a reported production of $9,000.

Indian Springs Drift Mine comprising 140 acres in Secs. 3 and 10, T. 23 N., R. 3 E., near De Sabla, was one of the profitably productive mines of the county. The last work was in 1920–1922 when Henry S. Porter had a lease on the property and E. F. Woodworth directed operations. The old working adit was repaired and was being advanced when the owner of the adjoining Hupp holdings sued for an injunction and work was stopped, after the adit is reported to have passed into the Hupp ground 700 feet, going upstream.

The old Indian Springs adit was started in 1860 and worked continuously for over 30 years, and finally reached a length said to be 6500 feet including turns, but showing 5200 feet long on a section. As described by E. B. Preston [1] the gravel breasts were 120 feet wide by 6 feet high and contained about 50 per cent cobbles and boulders. A shift's work for a miner was three carloads of gravel of 1500 pounds each, which yielded $7 to $8 a carload then. The average for the mine as a whole was less.

According to a map made at a later date than the above, there was a section of this channel about 750 feet long which was faulted down and where former work stopped. Work done under Woodworth passed through this faulted section, encountering a copious flow of water, which continued for five months. Pay gravel was reported, but obviously the expense of operation was high and the adit was expensive to keep open. A long section of this channel and its two supposed tributaries is believed to remain unworked on the adjoining properties

[1] Cal. State Min. Bur. R. XI, p. 159.

upstream belonging to Mrs. Hupp, Mrs. M. M. Understock et al., and Diamond Match Company. The face of the adit is 197 feet above the portal, indicating an average grade of nearly four per cent.

Kanaka Bar. W. E. Livesley and Bert Knapp of Oroville were reported to be preparing to build a barge here in June. An engine and a pump were to be mounted on it, and the gravel in the river was to be prospected with the pump, guided by a diver. This method has been followed on Feather River and American River before, and such an installation was described by the writer in the last Placer and El Dorado counties reports.

Kelly Hill Mine. Operated by Gold Wedge Divide Mining Company, Frank G. Steward, president, Russ Building, San Francisco. T. V. Barton, superintendent, Chico, c/o De Sabla stage. It is in Secs. 27 and 28, T. 23 N., R. 3 E., two miles south of De Sabla.

Four bedrock tunnels were run by previous operators. The present company have done considerable prospecting and have found coarse gold at times, but have been unable to follow any defined pay streak on account of pay being in a few large pieces. It appears as if the pay streak, coursing southwest had been crossed by later gutters, leaving pay in patches between the gutters and high on their rims, according to R. L. Phillips; Barton interprets the occurrence as a 'fingering out' of the gravel, as might occur in a delta. No work was being done at time of visit and these workings were not visited.

Barton was preparing to prospect a heavy bank of intervolcanic gravel lying about one-half mile west of the Kelly Hill Mine above the road, where a side canyon had cut the gravel. This has been worked from time to time by prospectors seeking a grubstake. The part carrying fine flaky gold is three to seven feet thick, containing greenstone cobbles mixed with lava mud and sand, has a lava roof and lies on a floor of cemented cobbles. It apparently filled so rapidly that there was no time for stratification. It is tight enough to require milling. There is an adit here about 400 feet long from which considerable gravel has been breasted. There is a 15-h.p. gasoline engine and small air compressor here. Three men were employed outside June 15.

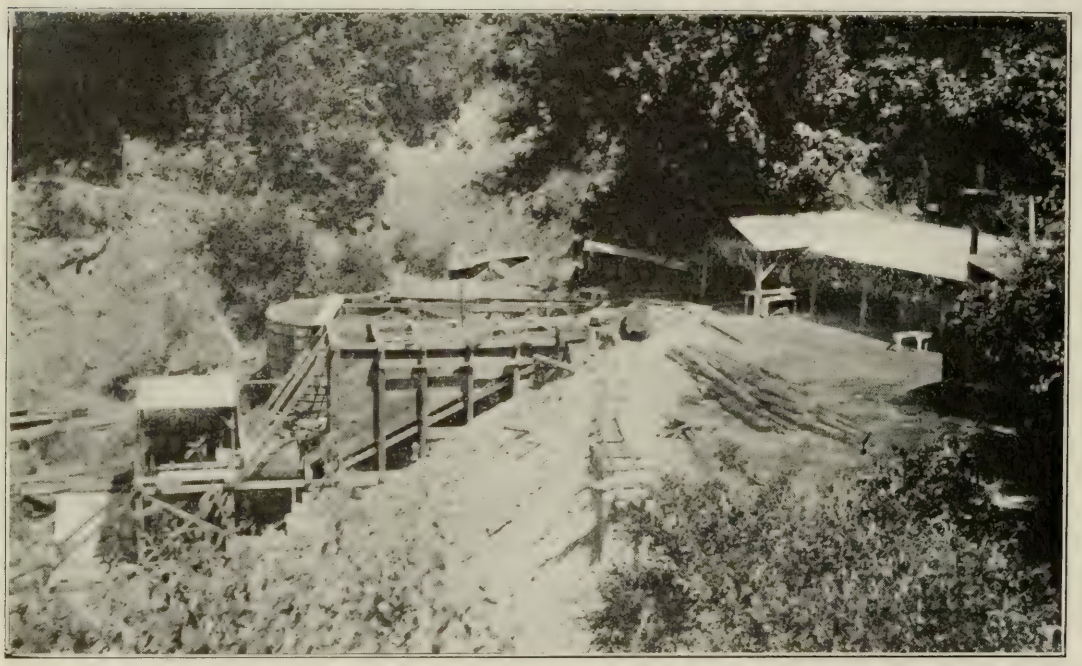
Little Butte Prospect is on Little Butte Creek one mile north of the Steiffer Mine. There are 80 acres of unpatented claims covering quartz and placer prospects. The latter lie along the creek where some ground on a flat of several acres has been partly prospected. J. and O. Van Ornum, John Smith and Jess Triplet, Box 38, Route 3, R. F. D., Chico, owners. One man was doing assessment work in June.

Lucky John Drift Mine. Enterprise Gold Mining Company, owner. A. J. Martens, president, 2902 Nineteenth Street, San Francisco. It contains 360 acres of placer mining ground and 30.67 acres in recently located claims, in Secs. 2 and 11, T. 22 N., R. 3 E., two miles north of Paradise. Most of the work has been done in the NW$\frac{1}{4}$ of NW$\frac{1}{4}$ of section 11. Arthur Delerey, superintendent.

The work done up to that time was described by the writer in our June, 1922, issue of MINING IN CALIFORNIA. The main working adit, running south and southeast, had reached a length of 566 feet then, and payable gravel had been opened near the face for a length of 100 feet, as well as at the top of a raise put up 45 feet vertically at a distance of 257 feet from the portal. Since then, the gravel opened in

both these places has been worked a little. The gravel on the main level was breasted for a maximum width of 60 feet and some branching drifts were run east 70 feet and west and southwest as much as 110 feet from the main crosscut, showing a width of over 100 feet of gravel. The bedrock pitches south to S. 20° W. It is reported to have paid for two feet next the bedrock in the pay streak. In breasting upstream from the main level a U-shaped bend was made and a steep tributary or gutter was followed 385 feet north. This, called the Blue Raise Channel, raised 44 feet in 385. It was breasted 10 to 25 feet wide. The face is scarcely 80 feet from the face of an old adit.

The 'Red Channel' was struck first in the raise from the main adit 257 feet from the portal, and again in a raise driven 100 feet west up the steep west rim of the 'Blue Raise Channel' 330 feet north of the turn from main adit. It is 26 feet higher here than the 'Blue Raise Channel.' This upper gravel has been worked for a length of 105 feet



Lucky John Drift Mine, near Paradise, Butte County.

southeast of the last raise, and 6 to 10 feet wide. It is older gravel than that below, the gold is coated with a rusty covering and the east rim is flat. This run may be an early bench. A raise is being put up to tap it in the south workings. The west rim was not seen, but there seems to be little doubt of the channel character of the gravel, although the old beach line is close, on the Mineral Slide property. This gravel is loose and has a great deal of sand.

The bedrock of the mine workings is Calaveras (Carboniferous) and Mariposa (Jurassic) slate, striking northwest and dipping northeast. About 700 feet in the adit going north to prospect the main channel, the adit crosses a quartz stringer lead in Mariposa clay slate. This lead is 20 feet wide, and a little specimen ore is reported in it, at the crossing, but no further work has been done on it yet. An auriferous lode system, reported 60 feet wide, strikes northwest 500 feet ahead of the north face.

Equipment includes two 5000-gallon tanks, a 14,000-gallon reservoir, 150 feet of 12-inch sluice, gravel bin of 50 cars capacity, two screens, one-drill compressor and electric motors. Seven men were employed in June, 1928.

Lydia Placer Mine was profitably worked by Dave Campbell, owner, Coutolenc, until deprived of a cheap water supply. This claim is on the Nugget channel just upstream from the Nugget Mine. Campbell states that pay was found on the short side of bends on high bars, but that the main channel carried no pay. Ground sluicing and drifting were employed. The channel here was only about 20 feet below the surface. A length of 250 feet out of 750 feet of channel on the property has been worked.

Mineral Slide Gold Mining Company's property contains 390 acres in N½ Sec. 10 and S½ of Sec. 3, T. 22 N., R. 3 E., 3 miles southeast of Magalia.

The holdings face on Little Butte Creek canyon for a length of a mile and extend south one-half mile. It has been worked intermittently for a long time, during which ten adits have been run, as follows:

No. 1, run 1200 feet a little south of east from Van Fossen Ravine, is partly caved. It started 575 feet northeast of the west ¼ section corner, going from bedrock into gravel.

No. 2, 300 feet long, all caved, showed gravel with a prospect of gold at the face, but it was too high. It started near the north ¼ section corner between sections 10 and 3.

No. 3 was run south then east, over 500 feet, passed through some old works and showed gravel 80 feet wide running $1.50 a cubic yard.

No. 4 is about 200 feet east of No. 3, and is 170 feet long with a raise of 10 feet to gravel in which it continued 127 feet. This paid well.

No. 5 adit paid well. It showed gravel and bedrock dipping south and west.

No. 6 is an early day adit, too high and caved. Adits 4, 5 and 6 are, in order, 200 to 250 feet apart and east of No. 3.

No. 7 is a double track tunnel 1260 feet long running southeast and connecting by a raise of 36 feet with No. 8, an incline running southwest 1200 feet. From the connection the incline was continued 400 feet. From these workings a large amount of gravel yielding from $1 to $10 or more a yard was mined. This was in part cemented or tight, and was washed four times, each washing yielding part of the gold, the total amount having been evidently $3 a cubic yard. Workings are caved.

No. 9 adit was started on the Lucky John property just east of the east line of the Mineral Slide, but entering the latter property almost at the southeast corner, then passing back into the Lucky John. This adit, now caved, is said to have shown pay gravel near the face. This is undoubtedly the same channel since developed a little farther east in the Lucky John Mine (which see).

No. 10 adit, started about midway of the property near the north line, between No. 2 and 3 adits, was run 1200 feet or more south, with the intention of extending it to the south property line and furnishing drainage and a working entry from which the property could be worked to advantage. It was to be on sluice grade of 5% to permit washing in boxes from the face. It was not completed and the property has lain idle 12 years or more.

The Mineral Slide property lies along a part of the Ione shoreline, the gravels lying partly on slate and partly on Cretaceous sandstones.[1] The sandstone below the gravel has yielded Chico (upper Cretaceous) fossils. The bedrock of the gravel sinks rapidly on this property from an elevation of 1500 feet on the north to about 1000 feet on the west, and there is an immense deposit of low grade gravel. On the rims and possibly also along gutters in this deposit, the good pay was found. The Lucky John Mine, immediately east, shows a defined channel on slate bedrock in their northerly workings without the evidence of marine action.

Mountain House Drift Prospect contains 20 acres in the center of Sec. 4, T. 21 N., R. 6 E., three-fourths mile from Mountain House on the creek of the same name. August Amend, owner, Berry Creek, c/o Mountain House.

This covers an old back channel of the creek, buried by an ancient landslide. It was drifted by former owners for 250 feet, when the workings were lost on account of water and running ground. It was reported to be rich. There is a distance of 1100 feet believed to remain unworked on the claim between the points where the present stream cuts the old channel.

The present owner has been working alone for several years, aiming to strike the channel with a bedrock adit which will drain the ground. The exact course of the old stream under the slide is uncertain and previous adits, including one 350 feet long, did not reach the objective, but the present working, now 200 feet long, is believed to be under the gravel, which will be tapped by a raise.

The *Nugget Drift Mine*, in S½ Sec. 36, T. 24 N., R. 3 E., was opened on the Nugget channel at Toadtown, and worked downstream at a profit for 200 to 300 feet. The present upper course of Little Butte Creek crosses this channel at Toadtown. The gravel carried pay distributed over a width of 60 feet. Mrs. Julius Smith, owner, Chico.

This channel passes downstream into the *Hupp* property, where a shaft and incline were sunk on it. Upstream, it enters the *Lydia* mine and passes from there into the *W. H. Walker* claim. This is locally considered as being probably a branch of either the Perschbaker or Indian Springs channels.

Oro Fino Mine. Robbers Roost Mining Company, W. F. Anderson, general manager, 903 Hobart Building, San Francisco. The company owns 360 acres in Secs. 10 and 11, T. 23 N., R. 3 E., just west of De Sabla, and has a lease and option on other land adjoining. Nat Lambert, superintendent.

The old Robbers Roost workings are in section 10, midway between the Emma and present Oro Fino workings. The Robbers Roost adit was about 2500 feet long with 1500 feet in length breasted; a small channel now being worked was also found there.

The total distance from the portal to face of main Oro Fino adit is 5800 feet. Present work is carried on through an incline shaft with a vertical depth of 125 feet, striking this adit 1300 feet from portal and at an elevation of 2250 feet. The old workings of the Oro Fino are described in past reports of the State Mining Bureau, in which the

[1] U. S. Geol. Survey A. XVII, pt. 1, p. 545.

width of pay gravel in the main run was given as 40 to 50 feet. The grade was steep and the pay is said to have been mostly on the serpentine bedrock. A small branch was struck 750 feet in and was worked; in a length of 225 feet, it rose 70 feet. The gravel in 1888 was said to pay $5 per 1800-pound car or $40 per shift per man.[1] In 1892, it was said[2] to pay $100 per man. In 1896 the main adit was 2700 feet long. Evidently the bulk of production was made by those former operators. The present company has had the mine 15 years, but has not made much production as they have been running mostly through old ground and bedrock, in search of the Emma channel.

The present main adit, which runs southeast and east, raises 110 feet in a distance of 3000 feet from the foot of shaft to junction with a small branch channel entering from the northeast. The main adit has been run about 1500 feet beyond this. Two faults with downthrows of nine and seven feet on the east side were crossed. At the face, they struck a third fault, also with downthrow on the east side. They have been sinking an incline here, which was 56 feet deep vertically early in June. Lambert thinks these are the same faults found in the Indian Springs Mine, three-fourths mile northwest, and expects to sink about 25 feet deeper before reaching the level where he can continue crosscutting. Work here had been suspended while awaiting a pump. Five men were running a drift upstream on the branch channel last mentioned. This had been followed at time of visit (June 14) for 500 feet and had raised 40 feet. It runs on serpentine bedrock, carrying black and rust-stained gold. The pay is 4 to 12 feet wide. Coarse, rough crystallized gold in subangular quartz is common. The face seen was in coarse sand, with from a few inches to one foot of gravel next the bedrock.

A line of 12-inch sluice boxes with riffles traverses the entire length of the workings nearly to the working face. Water is brought into the mine in a pipe line (8-inch outside diameter) from a reservoir below De Sabla, giving a pressure head of 326 feet at the working face. The face is bored with augers and after blasting with light charges the gravel and sand are washed with a hose into the sluices. The gold lodges on the bedrock and in the first few boxes, and tailings are carried out the adit. This is a cheap and rapid method of working, which has been adopted in some mines in this county where channels are steep enough to permit tunnels on a sluicing grade.

Electric power is available for pumping and lighting and a blower operated by water power is used for ventilation.

No description of Butte County placer mines could be concluded without mention of the *Perschbaker (Magalia* or *Lucretia) Mine.* It is in Secs. 13 and 24, T. 23 N., R. 3 E., $1\frac{1}{2}$ to 3 miles north of Magalia by road.

The first discovery was made by Birch and Barrett in 1855 on the bank of Little Butte Creek in $SW\frac{1}{4}$ of $SE\frac{1}{4}$ of Sec. 13, T. 23 N., R. 3 E., where rich gravel was found almost at creek level alongside a massive quartz vein. They followed this downstream in a westerly direction but after taking out rich pay lost their rights, which were acquired by Perschbaker. The latter continued the incline, following this channel, which proved to be a branch of another. The work was done under

[1] Calif. State Min. Bur. R. VIII, p. 118.
[2] Calif. State Min. Bur. R. XI, pp. 160–161.

great difficulty on account of water, a steam plant of four 4-foot by 16-foot boilers being required to run the ten pumps needed. This channel, only 4 to 20 feet wide[1] and with a meager amount of gravel, most of it subangular, was followed 3500 feet, in which distance it dropped 282 feet, the grade varying from 12% to 3%. It was very rich, coarse gold being plentiful.

In 1890, the property changed hands again. A perpendicular shaft 502 feet deep, was sunk one-half mile or more west of the discovery point, after the difficulty of working downstream in the incline became too great. The so-called Little Magalia channel, of which the Perschbaker was said to be a tributary, was worked downstream from this shaft 3950 feet, and upstream nearly 2000 feet, nearly or quite to the Campbell (now Steiffer), at a good profit. This channel was 50 to 60 feet wide with pay gravel up to six feet above bedrock, which was slate alternating with serpentine.[2] Two faults were encountered going downstream. Both showed upthrows on the south side, one of 5 feet and the other of 34 feet. The boulders from this channel appear to have been mostly greenish schist, serpentine and slate. Many interesting stories of the richness of the gravel are told. The production was no doubt over $1,000,000.

When the work on the north had reached the vicinity of the Joe Campbell property line, Campbell obtained an order from the court for a survey. The mine was at that time (December, 1899) allowed to fill with water and has since been idle.

The downstream portion of this channel has not been certainly identified and its course is not known.

Pitts Mine (Old Bader, or Mowry & Newman). It is in sections 1 and 2, T. 22 N., R. 3 E., a mile and a half from Magalia by road and trail. Owners, Mowry and Newman, San Francisco. Lessee, Lillian Mining Co., Maurice Reich, president, 125 Geary Street, San Francisco. J. M. Pitts, superintendent, Paradise.

The lessee has been prospecting the property since December, 1920. The work done up to June, 1922, was described in the report of the State Mineralogist for 1922, pages 260 and 261. The claims had been previously worked by hydraulicking and by a series of adits and are said to have made a production variously stated at from $75,000 to $200,000, but no definite records were shown to substantiate this. Since 1920 there has been little production.

Geological conditions here are mainly similar to those observed in the Bader Mine (which see). The same channel has been prospected. No. 1 adit, started at an elevation of 1930 feet (aneroid), was about 3000 feet long in July, 1928. Above it and to the south, raises and drifts have been run. The Reich raise reached a point nearly 70 feet higher than the portal on the east rim of the channel. The Pitts drift was run from the top of a raise from the main entry level, southward 200 feet. Another drift reached a point 300 feet south, where considerable water was struck. Here there is a lava-filled cut in the bedrock of the east rim, suggesting interesting geological possibilities in that direction. The present lower workings are not low enough to properly bottom the ground downstream.

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[1] Cal. State Min. Bur. R. XII, p. 87.
[2] U. S. Geol. Survey Prof. Paper 73, p. 93. Waldemar Lindgren.

From time to time, patches of payable gravel, containing one or two carloads each, have been found but the operators have not solved the problem of locating any definite pay streak, if such exists. The pay probably occurs in small streaks or gutters; the gold is coarse and coated black. The channel is not so well defined here as at the Bader Mine, as here it is much nearer the ancient shore-line.

There is a gas engine, blower and air-drill equipment on the claims, but recent work has been by hand, with three or four men employed.

A quartz vein 2 to 5 feet wide crosses the north end of the property.

Robison Drift Prospect is in Sec. 15, T. 24 N., R. 3 E., about three miles by road and trail from Berdan. W. A. Robison, Chico, c/o Forest Ranch, is in charge of prospecting, with a few men employed.

Royal Drift Mining Company prospected the property, working three shifts for several months, but gave up their lease. This prospect was not visited. Workings are reported to include an adit about 1200 feet long, which was 25 feet too high to bottom the channel, necessitating an incline, through which the later of the two channels described under the Dix Mine was prospected, and search is being made for the other.

Rotten Boulder Drift Mine is in the NW¼ Sec. 29, T. 22 N., R. 4 E., six miles from old Yankee Hill by Jordan Hill road and trail, on the east side of West Branch of Feather River. Knox Brothers, owners, Magalia, have been working the property and have run an adit nearly north 450 feet at an elevation of 1425 feet (aneroid). This follows a steep channel in a narrow winding trench with numerous large, hard boulders. The stream evidently followed a soft seam in a belt of schist or a dike; the face is entirely in bedrock or rotten granitic rock. The owners report a small production the past year.

Equipment includes a tractor, gasoline engine and vertical compressor. The Blue Hog Mine workings, perhaps on the same channel, but downstream and on the opposite side of the river, bear S. 70° W., about one-half mile and 175 to 200 feet lower.

Royal Drift Mining Company. R. M. Butler, Napa, California, president; Forest Snow, superintendent. The holdings cover nearly 800 acres for three miles along the lava-covered ridge west of Big Butte Creek in Secs. 27 et al., T. 24 N. R. 3 E., 23 miles from Chico via Forest Ranch, or eight miles by road and trail from Magalia. Present work is in the SW¼ Sec. 27, at 2350 feet elevation (aneroid).

The property, once called the Best Mine, was opened in 1879 by Best and Garland and they are thought to have produced about $35,000. The Napa and Solano Mining Company worked between 1890 and 1900 in the same adit now being used. They raised 30 feet above this when 650 feet in, and breasted a reported length of about 600 feet, for a width of 50 to 100 feet and a height of 5 to 6 feet. The present company has been in existence 20 years. Besides the work here, they ran an adit 1400 feet long in section 34, an adit 3000 and an incline 900 feet in Sec. 4, T. 23 N., R. 3 E. They have extended their present adit 2500 feet.

This main adit, starting in a westerly direction, branches 1500 feet in. One branch has been driven N. 8° W., 35 feet to a raise 12 feet high, from the top of which a crosscut was being run S. 45° W., to prospect a section of an early run of the Best channel, of which Snow

thinks there may be as much as 3000 feet remaining. This work was 200 feet in, and was still in bedrock, when visited.

From the fork, the main adit continues 1900 feet N. 64° W., where a fault was encountered; an incline was sunk 300 feet (90 feet vertically) but had not reached the opposite side of fault when the incline was lost, and a sudden flow of about 20 miners' inches of water filled it. This water still flows, only partly reduced in volume, and is used for washing gravel. As usual in this region, the low side of fault is on the upstream side. This channel is locally believed to be the Dix channel, not yet bottomed on this property. The amount of faulting is uncertain, but may be 175 feet.

At a point 1300 feet from adit portal, a crosscut was run 40 feet and an incline was run 300 feet (25 feet vertically) down the bed of a late run; a crosscut thence northwest 100 feet struck an older channel on nearly the same level. It was followed upstream 100 feet and about 200 cubic yards of gravel that paid $5 a yard in coarse gold was mined, when the channel steepened and work was stopped.

Four men were working underground, and several on the surface. A 25-h.p. semi-Diesel engine drives an 8½″ by 12″ air compressor, and a 7-h.p. engine runs an air blower. A McCormick gravel mill is used to wash gravel which is tight.

Steiffer Mine (formerly Joe S. Campbell P. M.). P. B. Steiffer Mining Company, owner, North Ivy Street, Chico. The mine is in Sec. 13, T. 23 N., R. 3 E., and contains 80 acres; members of the Steiffer family control it as well as mineral rights on SW¼ Sec. 12, (105 acres), SW¼ Sec. 1 (140 acres) and W½ of NW¼ Sec. 12 (70 acres).

The Steiffer shaft in E½ of NW¼ Sec. 13, was sunk vertically 334 feet and an incline was started at a point 20 feet north of the bottom of shaft, and was sunk toward the west on an angle of 45°. At 50 and 100 feet, layers of barren gravel were cut. At 100 feet they struck the contact between lava and bedrock, where the angle of incline was changed to 15°, it was sunk 250 feet farther, and pay gravel was found on serpentine bedrock at a vertical depth of 508 feet from the portal, or at an elevation of about 2070 feet. A flow of 580 to 600 gallons of water per minute had to be pumped. The channel was crossed to west rim, a distance of 60 feet. A drift was run downstream 40 feet. A drift was started north and a crosscut was run west 200 feet in serpentine bedrock all the way, in search of another channel, but nothing was found. The main drift north in the center of the channel was run about 170 feet, and is claimed to have been in gravel carrying gold. The company worked intermittently until 1917, but the total length worked up to 1914 was only 250 feet. Great difficulty was experienced in keeping the mine pumped out, due to amount of water and to litigation which interrupted operation as well as a number of accidents which cut off the electric power used for pumping. Two hydroelectric power plants were built on the West Branch, but for many years little mining was done.

In 1921 the Evening Star Mining Company unwatered the mine again and did some work but quit in financial difficulties without paying the men. The workings were again under water shortly after they quit, and have remained so since. One of the men then employed there stated that the upstream face was about 900 feet upstream from the face of the old Magalia drift, which is supposed to be about 200

feet from the Steiffer shaft. The former employees were given an opportunity to work gravel then exposed, to obtain wages due them. One of these men stated in 1922 that they had a breast of gravel 20 feet wide by 7 feet high worth $13 a cubic yard in place, but could not make it pay due to the number of men needed for surface work, hoisting, etc., with only four or five at the face. Two hoists had to be operated.

Underground equipment during the Steiffer regime included 10 centrifugal pumps of 700 gallons per minute capacity, one of 1000 gallons per minute and 2 steam pumps of 600 gallons per minute capacity. The hydroelectric power plant on the West Branch had a rated capacity of 700-h.p., but the water supply was not always enough to run it. The transmission line has been stripped of wire. Other equipment now at the shaft, in buildings, which are in poor repair, includes 3 boilers, 10″ by 12″ compressor, double hoisting equipment (steam and electric) and an old style 52-h.p. motor.

The Steiffer workings are claimed by the owners to be on the upstream extension of the Little Magalia channel, which was worked up near to the property line previous to 1899.

IRON

Prospects of iron ore found in Butte County have been mostly in the form of float. The following were mentioned in Bulletin 38: Sec. 5, T. 25 N., R. 4 E., at an altitude of 6000 feet, float. Secs. 7 and 27, T. 23 N., R. 4 E., float. Sec. 30, T. 25 N., R. 5 E., heavy iron float. Secs. 5 and 8, T. 25 N., R. 4 E., old locations.

A vein in Sec. 3, T. 22 N., R. 3 E., in serpentine bedrock is said to carry 60% iron, 5% to 8% manganese and a trace of chromite.

LIMESTONE AND MARBLE

Small bodies of limestone and marble occur in the eastern half of the county where the bedrock formations are exposed, as near Pulga and Intake; and between Pentz and Yankee Hill, where some quarrying and burning of limestone was carried on 25 to 35 years ago.[1] The last recorded production was in 1903.

Other properties mentioned in our Bulletin 38, page 98, are noted below. Several are too far from railroad to be utilized except locally.

Big Bend Marble Quarry in Sec. 32, T. 22 N., R. 5 E., described as showing a ledge of blue limestone, and another of white marble. It is near Intake on Western Pacific Railway.

Marble Creek Deposit in Sec. 10, T. 22 N., R. 6 E., a "heavy cropping of white marble." This is a little east of Merrimac. A logging railroad passes within two miles of several small lenses of limestone which occur almost on the county line.

Mooretown Marble is in Sec. 24, T. 20 N., R. 6 E., two miles southeast of Mooretown. Described as a "ledge of white marble."

Pentz Marble is in NW¼ Sec. 8, T. 21 N., R. 4 E., about five miles northeast of Pentz. The ledge is said to extend for a mile northwest through the center of this section. Some lime was burned here many years ago.

[1] Cal. State Min. Bur. R. XI, p. 157.

Other bodies of limestone have been noted in Secs. 7, 17, 18, and 20, T. 21 N., R. 4 E.

MANGANESE [1]

Bear Canyon Mine. George W. Wooley, owner, Clipper Mills. In Sec. 35, T. 20 N., R. 7 E., one-half mile northwest of Clipper Mills. An orebody of manganese oxide containing 40% ore, produced 220 tons when worked in 1916 by Noble Electric Steel Company. Idle now. The property is 32 miles from Oroville, nearest railroad point.

Powell Prospect. E. V. Powell, Clipper Mills, last known owner. It is in Sec. 35, T. 20 N., R. 7 E., one mile north of Clipper Mills. A siliceous, manganese-bearing ledge was reported in 1917.

View Point Prospect, owned by E. C. Binet, Clipper Mills, is in SE¼ Sec. 34 and SW¼ Sec. 35, T. 20 N., R. 7 E., three-fourths mile northwest of Clipper Mills. Only a little shallow work has been done, showing prospects of siliceous manganese ore.

Jack Johnson, Magalia, found manganese ore in the county and listed same in our Monthly Commercial Mineral Notes during the present spring. Though many inquiries were made and samples submitted to those interested, it is said these proved too siliceous. In Johnson's absence, his associate refused information as to the location of the prospect.

MINERAL PAINT

Chico Ocher and Mineral Paint Company. Owners, Mrs. Frank Henshaw and Hochheimer and Company, Willows. An ocher deposit occurs on 360 acres of land in Secs. 5 and 6, T. 23 N., R. 4 E., near the Doon road and a mile from the Southern Pacific Railroad.

There was some production previous to 1900. The deposit was worked through an adit 200 feet long and a small open cut.

MINERAL SPRINGS

Mineral springs of the county are described and analyses of their waters are given in Water Supply Paper 338, U. S. Geological Survey.

Mt. Ida Spring is six miles east of Oroville. It supplies a carbonated water which has been used locally and has also been bottled.

Richardson Springs are in the canyon of Mud Creek ten miles northeast of Chico. There are four principal springs and a smaller one. They are classified as saline springs, some of concentrated character. One spring in particular carries considerable sodium, a moderate amount of potassium and calcium, and marked amounts of the chloride and sulphate radicals.

A popular and successful resort has been built up around these springs, with hotel accommodations for the large numbers who use the water for medicinal purposes. Water is also bottled. *Natural gas* from one of the springs is trapped and utilized in the hotel.

PLATINUM GROUP METALS

Platinum, iridium and other members of this family of metals, were recovered to the amount of 100 ounces or more annually when gold

[1] Cal. State Min. Bur. Bull. 76, pp. 30–31.

dredging was in full blast, but in later years this has dwindled to only a few ounces a year.

The platinum metals taken on the dredgers occurred in small, thin flakes carrying 68% to 72% platinum and about 20% osmiridium. These metals have also been noticed at some of the drift mines, and there has been a small output from the surface placers and river bars on the upper course of Feather River.

Bibl: Cal. State Min. Bur. Bull. 85.

SILVER AND LEAD

Bonanza King Prospect. Owner, John Wells, Yankee Hill. In May, 1928, an option was held by Lloyd Root, San Francisco, and it is reported he and others have recently started work. This prospect of four claims is in Sec. 16, T. 25 N., R. 5 E., about six miles east of Chapparal at a reported elevation of 6000 feet.

Wells has done assessment work for several years, in the course of which a prospect shaft reached a depth of 24 feet and a few small shipments of a ton or less each of sorted ore were made. This came from a streak reported about 16 inches wide in a wide vein. The property was not visited.

A shipment of 2230 pounds in 1924 gave 0.57 oz. gold, 112.58 oz. silver, 4.65% copper, 53.4% silica, 1.8% iron and 2.6% alumina (Kennett smelter). Another lot of 1720 pounds shipped in November, 1927, carried 0.71 oz. gold, 96.65 oz. silver, 8% lead, 3.4% copper, 6.4% zinc, 2.1% antimony, 0.1% arsenic, 2.7% iron, 61.6% insoluble. After all charges and deductions, the net return on the latter lot was $39.68 (Selby smelter).

Stirling City, the nearest railroad point, is 20 miles distant. The mine is connected by a steep trail with road.

The ores of a few other prospects in the northeastern part of the county carry lead and silver.

STONE INDUSTRY

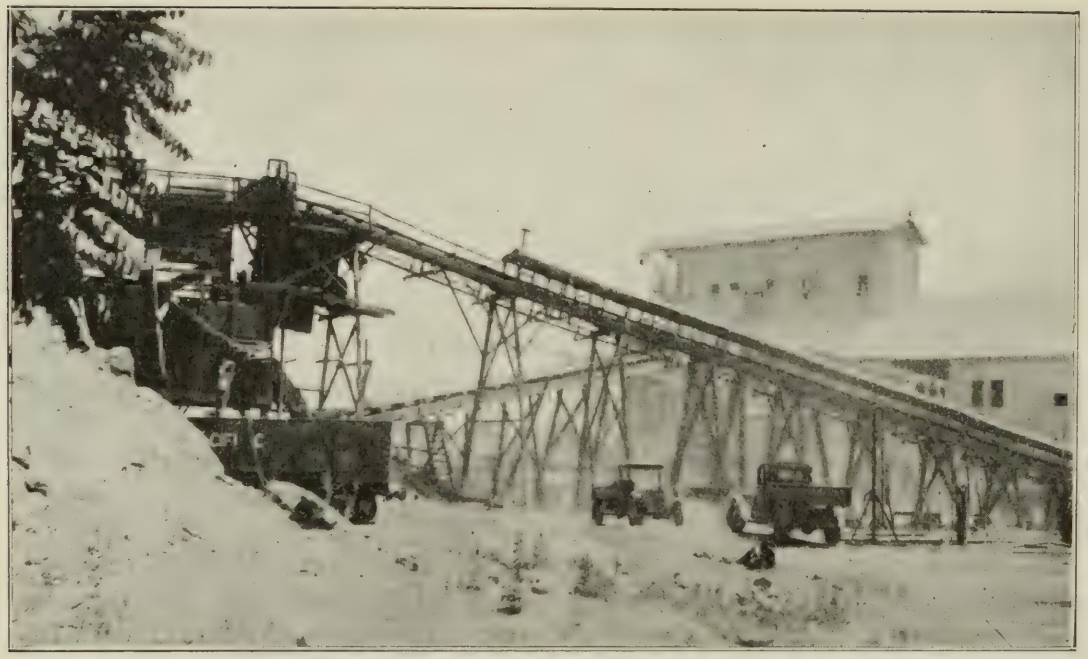
There are three plants in the county which produce crushed rock, sand and gravel from the piles of dredger tailings near Oroville and Chico. The supply of such material is immense.

Bechtel-Kaiser Rock Company, Oroville, has recently installed and put in operation a rock crushing plant about two miles south of Oroville.

Coast Rock and Gravel Company. Main office Hunter-Dulin Building, San Francisco. The Oroville plant is within the city limits. It belongs to Natomas Company of California and is operated under lease. H. W. Thorne, superintendent.

This plant has a daily capacity of 1000 tons of crushed rock and 1000 tons of gravel. Crushed rock is produced in standard sizes from $2\frac{1}{2}$-inch to dust, gravel $\frac{1}{4}''$ by $2''$, $\frac{1}{4}''$ by $1''$ and pea gravel, besides which special sizes can be supplied.

Rock is loaded by steam shovel and hauled a mile and a half in 6-yard and 12-yard cars by gasoline locomotives. The scalping screen separates rock for the crushers, of which there are one $36''$ by $24''$, one $36''$ by $18''$ and two $36''$ by $10''$. The larger rocks go to the first of these, while that from two to four inches goes to the $36''$ by $10''$



Plant of Coast Rock and Gravel Company at Oroville.

crushers, and minus 2-inch gravel goes direct to the washing screen. Rock and gravel is stored in bins and stockpiles. There are spur tracks from both the Western Pacific and Sacramento Northern Railways. Thirty-five men are employed.

Johnston Rock Company, Chico. J. E. Johnston, manager. This rock crushing plant is utilizing old dredger rock piles left by El Oro Dredging Company on Butte Creek about a mile and a half from Chico.

TALC AND SOAPSTONE

These are widely distributed in those parts of the county where the bedrock formations are exposed, but many of the deposits are a considerable distance from railroad and are undeveloped. Soapstone is a common mineral in the state and in other counties deposits near railroad have supplied the demand, with consumers in a position where they can choose from a number of available sources of supply at a low price.

Soapstone occurs in the vicinity of serpentine dikes and amphibolite schist which traverse the county at intervals striking northwest, and is exposed in some of the deep canyons and along the higher ridges where these are not covered by lava. Another rock commonly called soapstone but different in its rock associations from the above and really a mica schist, is found in some of the older rocks of the higher mountains, but has been used only a little locally for fireplaces.

McLean Soapstone Mine contains 19 acres in Sec. 32, T. 22 N., R. 5 E., on north side of North Fork of Feather River midway between Intake and Blinzig, on Western Pacific Railway. Walter S. McLean, 1919 San Bruno Avenue, San Francisco, owner.

This is one of the first class of deposits mentioned. Because of favorable working conditions, and nearness to the railroad, McLean has been able to produce cheaply. The rock is shipped to the bay cities for use in roofing, etc.

REDDING FIELD DIVISION

CHAS. VOLNEY AVERILL, Mining Engineer

TEHAMA COUNTY

Geography and Topography

Tehama county lies in the north central portion of the state, and is practically entirely within the basin of the Sacramento River and tributary streams, just a little south of the point where the river emerges from a narrow cañon to enter a broad valley. The central portion of the county is traversed from north to south by the Sacramento River with a broad expanse of lowlands, but the mountains on both the east and west edges of the county rise to elevations of upwards of 7000 feet. The lowlands are devoted to diversified farming, and much of the other land is suitable for the raising of sheep, cattle and hogs, so agriculture is the chief industry of the county. Other industries of some importance are the development of hydroelectric power from the streams flowing into the Sacramento from the east, by the Pacific Gas and Electric Company, and lumbering by such concerns as the Red River Lumber Company and the Diamond Match Company. Transportation is furnished by the Southern Pacific Railroad, following in a general way the course of the Sacramento River, and a paved highway following the same route, with good graveled branch roads running out to the east and west.

Geology

In general, a study of the geology[1] of the county shows that a belt of Jurassic metamorphic rocks, including a band of serpentine, runs north and south through the western part, a belt of recent clays and gravels deposited by the Sacramento River runs in a similar direction through the central part, and the eastern portion is covered by Tertiary lavas. On either side of the river deposits, an area of Tertiary sedimentary rock exists. With the lava covering the eastern portion and the river deposits covering the central portion, it is not surprising than few mineral deposits are found in Tehama County.

Mining

Mining is practically at a standstill in Tehama. The last report on the county is contained in Report XV of the State Mineralogist, which is now out of print, so the resources of the county are reviewed here, with added notes on recent developments of interest.

Among its mineral resources are listed: brick, chromite, copper, gold, manganese, marble, mineral water, salt and miscellaneous stone.

The table herewith gives the total recorded output of mineral products from 1880 to 1927, inclusive.

[1] Cal. State Min. Bur. Bull. 72.

Year	Gold, value	Chromite		Brick	
		Tons	Value	M.	Value
1880-1884	$22,000				
1894		1,680	$12,680		
1895		950	9,025	500	$2,500
1896		56	475		
1897					
1898				200	1,400
1899				300	1,800
1900				325	2,200
1901				300	2,000
1902				500	3,500
1903				600	4,500
1904				500	3,500
1905				650	5,000
1906				700	5,600
1907				400	3,200
1908				400	3,000
1909					
1910				600	3,600
1911					
1912				225	1,300
1913				300	1,800
1914					
1915		[2]		400	2,700
1916		1,896	39,702	[2]	
1917		2,053	41,646		
1918		3,261	152,291		
1919		[2]			
1920					
1921					
1922				[2]	
1923					
1924		[2]		[2]	
1925				[2]	
1926				[2]	
1927				[2]	
Totals	$22,000	[2]9,896	$255,819	[2]6,800	$47,600

[1]Includes crushed rock, rubble, sand, gravel.
[2]See under 'Unapportioned.'

CHROMITE

Chromite is found associated with the belt of serpentine which runs through the western portion of the county in a general north and south direction. *Kleinsorge Property.* In Sec. 27, T. 25 N., R. 7 W., Wm. E. Kleinsorge, attorney, of Sacramento, owns a mine which produced chromite during the late war, but which is now idle and in the hands of a caretaker.

Savage Bros. Lease. On the recommendation of S. D. Furber of Red Bluff, J. C. Savage and I. J. Savage of Red Bluff, have made application for a lease on state land in Sec. 16, T. 25 N., R. 7 W. They expect to mine high grade chromite from lenses in the serpentine and also to mine rock in large quantities through which the mineral is disseminated. They will concentrate the chromite from this material with machinery installed on the property by former owners, but will drive the machinery with water power instead of with gasoline engines, as was formerly done. They also expect to exploit deposits of magnesite. This property was formerly operated by the Noble Electric Steel Company.

CLAYS

O'Conner Brothers of Red Bluff are owners of a clay deposit in Sec. 29, T. 27 N., R. 3 W., from which they make common brick for

COUNTY, 1880-1927.

Mineral water		Salt, value	Miscellaneous stone[1], value	Miscellaneous and unapportioned		
Gallons	Value			Amount	Value	Substance
10,000	$2,400					
54,000	8,000					
10,000	18,000					
20,000	4,000					
5,000	2,500					
8,000	4,000					
8,000	4,000					
550,000	55,000					
20,000	2,000	300				
5,000	500	300				
5,000	500	300				
5,000	500					
75	42		$600			
100	100	200				
1,000	500	[2]	750		$752	Chromite and salt.
[2]			11,076		3,575	Brick, granite, mineral water, natural gas.
			2,373			
			2,500		2,800	Other minerals.
			7,500		1,500	Other minerals.
			[2]		26,400	Unapportioned.
			30,520		300	Other animals.
			[2]		9,388	Brick and miscellaneous stone.
			4,900		1,316	Other minerals
			26,054		8,400	Brick and chromite.
			[2]		77,183	Brick and miscellaneous stone.
			2,100		8,240	Brick and chromite.
			[2]		5,350	Brick and miscellaneous stone.
[2]701,175	$102,042	[2]$1,100	[2]$88,373		$145,204	

local use. Most of the work is done by hand; the brick press, however, is operated by the power of two horses. Nine men can produce 8000 bricks per day. They did not make any brick in 1927, and do not expect to make any in 1928, because of a stock on hand.

Deposits of clay which is of some value for filtering oils and deposits of diatomaceous earth occur in the county, but these are not being worked.

COPPER

The property formerly held by the *California and Massachusetts Copper Mines Company* in Sec. 25, T. 27 N., R. 9 W., on the north slope of Tom's Head Mountain, is now held by J. M. McCampbell and Mrs. P. O. Thomas of Red Bluff. It is described by W. B. Tucker in State Mineralogist's Report XV, who states that the ore is chalcopyrite associated with pyrite, and that it has a low copper content. Enough work is being done annually to hold seven claims.

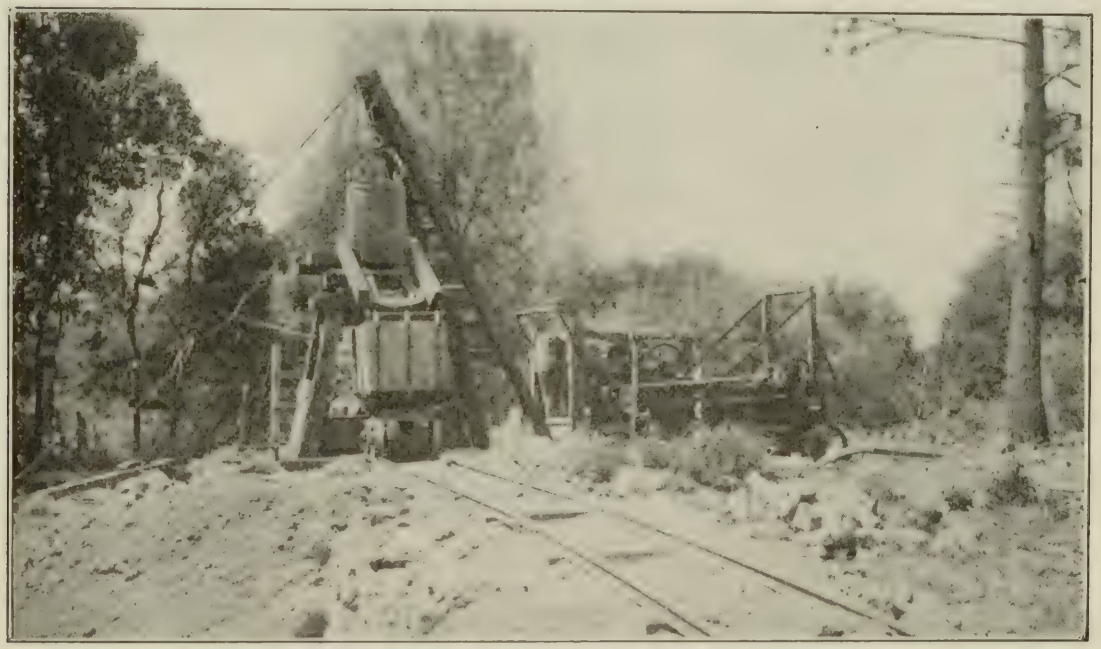
GOLD

Joe Arnol Prospect. Joe Arnol of Manton is sinking a prospect shaft for gold on Sec. 28, T. 30 N., R. 1 E., one mile south of Manton. He states that he drilled a six-inch hole which penetrated the basaltic lava at a depth of 32 feet and entered gravel which continued to a depth of 50 feet. A sample of this gravel, which he sent to a San Francisco

assayer, was said to contain $13.50 per ton in gold. At the time of the visit to this prospect the shaft was down 30 feet in closely packed boulders of vesicular basaltic rock. A home-made well-drilling rig was being used as a hoist, as is shown in the photograph.

W. A. Fish of Red Bluff states that years ago some Chinese washed gold from the Sacramento River gravels near Jelley's Ferry by ground-sluicing. Later a dredger was built to work the deposit, but it was of faulty design and never operated. Nothing has since been done with the deposit.

Chas. M. Holbert and others of Beegum, recorded several lode locations in the Beegum district in 1926 and 1927, which they say contain gold.



Joe Arnol's Prospect near Manton, Tehama County.

MANGANESE

Several manganese prospects have been found associated with the belt of serpentine in the western portion of the county. One of these is in Sec. 20, T. 23 N., R. 7 W. No important production has been made from them, and they are now idle.

MINERAL SPRINGS

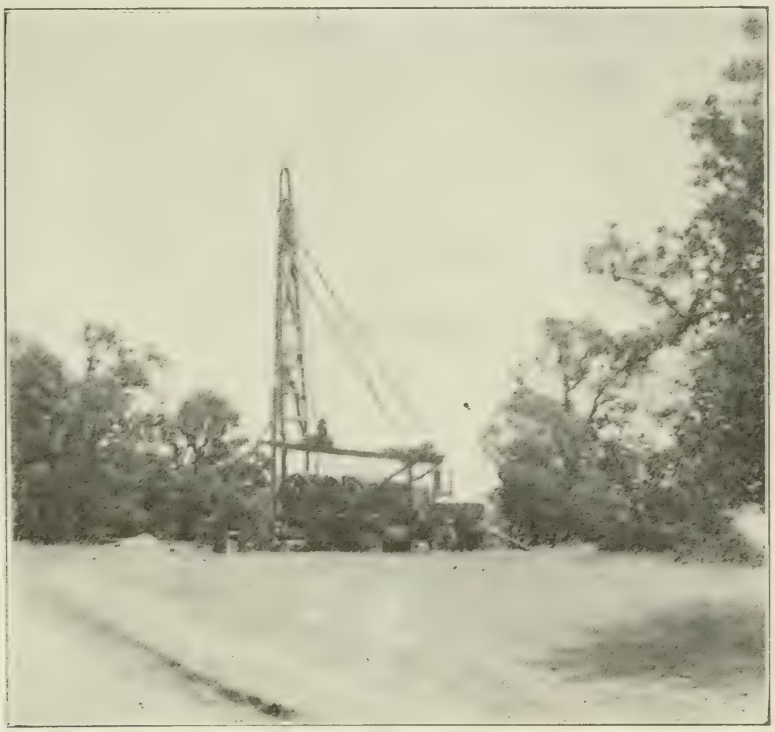
Morgan Springs are situated about 50 miles northeast of Red Bluff. Tucker[1] says "There is a group of 25 springs and pools scattered for a distance of ¼ mile in a meadow along Mill Creek; this meadow is termed Big Hot Spring Valley. Most of them are quiet pools of small flow, as a rule less than five feet in diameter and relatively shallow. A number of them contain thick algous growths, and several deposit native sulphur." These springs are now held in the name of the *Meadow Ranch Company,* care of R. W. Hanna of the Standard Oil Company, San Francisco. Mr. Hanna is reported to be improving them as a summer home.

[1] Tucker, W. Burling, Report XV of the State Mineralogist, p. 263.

Tuscan Springs are situated 10 miles northeast of Red Bluff, near the head of the cañon of Salt Creek. There are about 50 springs of water of different saline content. Some are rich in salts of potassium and sodium, some give off illuminating gas in usable quantities, and some are strongly sulphuretted as well as saline. There was at one time a large hotel at these springs and the place was popular as a health resort. The hotel and several buildings burned in 1917, and were never rebuilt. The place is now for sale by the estate of Martha Walbridge, of which W. A. Fish of Red Bluff is attorney.

GAS AND OIL

The *Tehama Oil Syndicate,* care of E. S. Bruce, 216 East First Street, Long Beach, is drilling a well with a water-well rig on Sec. 20, T. 24 N., R. 5 W. The driller, O. L. Wilder of Corning, reports a



Gas Well of Tehama Oil Syndicate in Sec. 20, T. 24 N., R. 5 W., at Flournoy, Tehama County.

strong flow of gas at a depth of 295 feet, and a gravel containing water at 300 feet. At the time of the visit to this well no flow of gas was evident, the reason given being that the water had come up to within a few feet of the surface, and had shut off the flow. Cuttings from the hole scattered around the well indicated that the upper part of the hole was in a hard blue clay and the lower part in a gravel composed of andesitic pebbles with very abundant fragments of white quartz. The photograph shows this well.

Other wells in this section which flow usable quantities of gas, and some of which flow artesian water in addition, are owned by Flournoy Union School, Flournoy, Sec. 20, T. 24 N., R. 5 W.; I. W. Brunk, Flournoy, Sec. 30, T. 24 N., R. 5 W.; R. J. Black, Red Bluff, Sec. 24, T. 25 N., R. 6 W.; J. J. Heavey, Flournoy, Sec. 16, T. 24 N., R. 5 W.

S. D. Furber[1] of Red Bluff has published a report which states that conditions are favorable in Tehama County for the discovery of petroleum. Mr. Furber has an interesting collection of mineral specimens and fossils obtained from Tehama and nearby counties.

SAN FRANCISCO FIELD DIVISION

C. McK. Laizure, Mining Engineer

On account of unfinished field work there is no report from the San Francisco Field Division in this issue.

LOS ANGELES FIELD DIVISION

W. Burling Tucker, Mining Engineer

On account of unfinished field work there is no report from the Los Angeles Field Division in this issue.

[1] S. D. Furber, Oil News, Vol. 1, No. 2, Sacramento.



OIL FIELD DEVELOPMENT OPERATIONS

By R. D. Bush, State Oil and Gas Supervisor

From April 1, 1928, to and including June 30, 1928, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
COLUSA COUNTY:					
E. and G. Products Co.	2	14	5	1	
FRESNO COUNTY:					
California Northern Petroleum Co.	2	21	14	19	Coalinga
Zier Oil Co.	1	20	14	28	Coalinga
Zier Oil Co.	1	20	14	N-7	Coalinga
Zier Oil Co.	1	20	14	N-8	Coalinga
Zier Oil Co.	1	20	14	N-9	Coalinga
HUMBOLDT COUNTY:					
Revert Mining Co.	6	3	1	1	
KERN COUNTY:					
H. J. Bardwell	24	28	20	Tillinghost 1	Belridge
Berry Oil Co.	30	28	21	86	Belridge
Berry Oil Co.	30	28	21	87	Belridge
Berry Oil Co.	30	28	21	90	Belridge
Berry Oil Co.	30	28	21	91	Belridge
Hugh Porter	36	28	20	2	Belridge
Hugh Porter	36	28	20	3	Belridge
Standard Oil Co.	31	30	25	Kern Co. Lease No. 1 27	Elk Hills
Betts Petroleum	25	28	27	Sturgeon 5	Kern River
Boston Petroleum Co.	20	28	28	26	Kern River
Brownmoor Oil Co.	16	28	27	Cauley 11	Kern River
Brownmoor Oil Co.	16	28	27	Cauley 32	Kern River
California Star Oil Co.	22	28	27	6-40	Kern River
Clyde De Lano	34	28	28	1	Kern River
Pan American Petroleum Co.	22	28	27	29	Kern River
Petroleum Securities Co.	22	28	27	4-B	Kern River
J. F. Harrison	20	30	22	7-A	McKittrick
The Ohio Oil Co.	8	30	22	1	McKittrick
C. C. M. O. Co.	8	32	23	84	Midway
C. R. Craft	21	31	22	7	Midway
Honolulu Consolidated Oil Co.	6	32	24	14	Midway
Honolulu Consolidated Oil Co.	8	32	24	23	Midway
Honolulu Consolidated Oil Co.	8	32	24	24	Midway
North American Oil Cons.	2	32	23	13-A	Midway
North American Oil Cons.	32	31	24	30	Midway
North American Oil Cons.	30	31	24	45	Midway
Republic Petroleum Co.	8	32	23	32	Midway
Standard Oil Co.	19	31	24	83	Midway
Standard Oil Co.	29	31	24	83	Midway
Standard Oil Co.	29	31	24	84	Midway
Standard Oil Co.	33	31	24	84	Midway
Standard Oil Co.	33	31	24	85	Midway
Standard Oil Co.	19	31	24	91	Midway
Standard Oil Co.	1	32	23	218	Midway
Standard Oil Co.	7	32	24	229	Midway
Fred J. Elliott	20	27	28	1	Mt. Poso
General Petroleum Corp.	21	27	28	Glide 21 12	Mt. Poso
General Petroleum Corp.	21	27	28	Glide 21 30	Mt. Poso
R. S. Lytle	26	27	28	1	Mt. Poso
Alfred L. Marsten	34	27	28	1	Mt. Poso
Modoc Petroleum Corp.	32	26	28	Kathryn-Hyde 3	Mt. Poso
Petroleum Securities Co.	21	27	28	Glide 1	Mt. Poso
Petroleum Secutities Co.	22	27	28	Reuch 6	Mt. Poso
Shell Co.	7	27	28	Glide 1	Mt. Poso
Shell Co.	1	27	27	Glide 4	Mt. Poso
Signal Gasoline Co., Inc.	27	27	28	2	Mt. Poso
The Texas Co.	15	27	28	Glide 2 2	Mt. Poso

OIL FIELD DEVELOPMENT OPERATIONS—Continued

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued					
The Texas Co.	15	27	28	Glide 2 3	Mt. Poso
Elbe Oil Land Development Co.	20	28	29	Freeman 1	Round Mountain
General Petroleum Corp.	30	28	29	Conry 5	Round Mountain
The Kern River Oil Fields of California, Ltd.	13	28	28	Kernco 2	Round Mountain
Fred M. Sayre	10	28	28	Sayre-McNeil 1	Round Mountain
Shell Co.	4	28	28	Fuhrman 1	Round Mountain
Shell Co.	29	28	29	Jewett 3	Round Mountain
Lake View Oil and Refining Co.	4	11	23	Midway Fields 9	Sunset
Midway Northern Oil Co.	7	11	23	1	Sunset
Standard Oil Co.	31	12	23	225	Sunset
Exeter Oil Co.	1	29	20	Pray 2	Temblor
Standard Oil Co.	28	11	20	Kern Co. Lease 2 34	Wheeler Ridge
California Petroleum Corp.	22	31	29	Pauley 1	
A. Bruce Frame	6	26	28	Villard 1	
General Petroleum Corp.	35	25	25	Stiles 1	
E. C. Johnson	33	25	27	Jasmin 1	
Milham Exploration Co.	8	28	23	Hume 1	
Milham Exploration Co.	5	28	23	Kern 5	
North American Royalty Co.	8	28	25	1	
The Pacific Eastern Production Co.	6	30	28	3-KCL-A	
Shell Co.	6	29	27	K. C. L. 1	
Southern California Gas Co.	10	28	23	1	
Superior Oil Co.	9	29	27	Ansolabehere 1	
LOS ANGELES COUNTY:					
Union Oil Co.	33	3	13	Callender 24	Dominguez
Pacific National Co.	7	2	14	6	Inglewood
Standard Oil Co.	8	2	14	Baldwin-Cienega 39	Inglewood
Standard Oil Co.	17	2	14	Baldwin-Cienega 56	Inglewood
Standard Oil Co.	16	2	14	Baldwin-Cienega 64	Inglewood
Standard Oil Co.	16	2	14	Baldwin-Cienega 72	Inglewood
Standard Oil Co.	17	2	14	L.A.Invest.1 56	Inglewood
Adams and Carrey	19	4	12	1	Long Beach
Bolsa Chica Oil Corp.	30	4	12	Combs 2	Long Beach
Bush-Voorhis Oil Co.	19	4	12	24	Long Beach
California Petroleum Corp.	30	4	12	Buell-Ryder 1	Long Beach
California Petroleum Corp.	19	4	12	Harlow 10	Long Beach
California Petroleum Corp.	19	4	12	Harlow 11	Long Beach
California Petroleum Corp.	19	4	12	Moore 4	Long Beach
California Petroleum Corp.	30	4	12	Shilling 5	Long Beach
California Petroleum Corp.	20	4	12	Yochem 4	Long Beach
Cannon-Jones Oil Co.	29	4	12	Hall-Webber 1	Long Beach
F. W. Combs	30	4	12	9	Long Beach
Continental Oil Co.	24	4	13	Benio 1	Long Beach
Continental Oil Co.	19	4	12	Young 1	Long Beach
Dabney-Johnston Oil Corp.	24	4	13	11	Long Beach
Dabney-Johnston Oil Corp.	30	4	12	13	Long Beach
Dabney-Johnston Oil Corp.	29	4	12	14	Long Beach
Dabney-Johnston Oil Corp.	19	4	12	15	Long Beach
D'Angelo Oil Co.	19	4	12	3	Long Beach
General Petroleum Corp.	30	4	12	Clock 5	Long Beach
General Petroleum Corp.	30	4	12	Jonah 6	Long Beach
General Petroleum Corp.	19	4	12	K. and H. 10	Long Beach
General Petroleum Corp.	19	4	12	Mission 3	Long Beach
Graham-Loftus Oil Co.	19	4	12	Daly 1	Long Beach
Graham-Loftus Oil Co.	19	4	12	Lightburn 4	Long Beach
Hancock Oil Co.	29	4	12	Signal 9	Long Beach
Hancock Oil Co.	29	4	12	Signal 10	Long Beach
Hancock Oil Co.	19	4	12	Signal 11	Long Beach
Herndon Petroleum Corp.	28	4	12	Herndon 8	Long Beach
Herndon Petroleum Corp.	29	4	12	Herndon 9	Long Beach

OIL FIELD DEVELOPMENT OPERATIONS—Continued

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
George A. Langstaff	13	4	13	Bixby 1	Long Beach
Marine Corp.	19	4	12	63	Long Beach
McKeon Drilling Co., Inc.	29	4	12	Macrate 2	Long Beach
W. F. Meyer	19	4	12	2	Long Beach
Miley Oil Co.	19	4	12	Mills 8	Long Beach
Pan American Petroleum Co.	29	4	12	Anderson 4	Long Beach
Richfield Oil Co.	19	4	12	Bernstein 3	Long Beach
Richfield Oil Co.	29	4	12	Booth 11	Long Beach
Richfield Oil Co.	29	4	12	Britsch 2	Long Beach
Richfield Oil Co.	28	4	12	Connett 2	Long Beach
Richfield Oil Co.	29	4	12	Denni 8	Long Beach
Richfield Oil Co.	30	4	12	Ella 2	Long Beach
Richfield Oil Co.	29	4	12	Freeman 5	Long Beach
Richfield Oil Co.	30	4	12	Hass 18	Long Beach
Richfield Oil Co.	19	4	12	Meader 1	Long Beach
Richfield Oil Co.	19	4	12	R. C. 9	Long Beach
Richfield Oil Co.	20	4	12	Roco 1-A	Long Beach
Rio Grande Oil Co.	28	4	12	B-8	Long Beach
Rio Grande Oil Co.	28	4	12	B-9	Long Beach
J. Orville Seeple	19	4	12	Seeple 2	Long Beach
Shell Co.	29	4	12	Alamitos 33	Long Beach
Shell Co.	29	4	12	Alamitos 34	Long Beach
Shell Co.	29	4	12	Andrews 7	Long Beach
Shell Co.	29	4	12	Babb and Tucker 4	Long Beach
Shell Co.	29	4	12	Cherry Hill Comm. 7	Long Beach
Shell Co.	19	4	12	Cresson Comm. 12	Long Beach
Shell Co.	29	4	12	Dobyns 6	Long Beach
Shell Co.	29	4	12	Goddard 6	Long Beach
Shell Co.	29	4	12	Hutton Comm. 8	Long Beach
Shell Co.	29	4	12	Hutton Comm. 9	Long Beach
Shell Co.	29	4	12	Jones Comm. 9	Long Beach
Shell Co.	29	4	12	Kent-Garth 5	Long Beach
Shell Co.	29	4	12	Martin Comm. 5	Long Beach
Shell Co.	29	4	12	Nesa 8	Long Beach
Shell Co.	29	4	12	Nesa 9	Long Beach
Shell Co.	29	4	12	Shell Fee Land 4	Long Beach
Shell Co.	29	4	12	Stakemiller 5	Long Beach
Shell Co.	29	4	12	Stratton 3	Long Beach
Charles A. Son	19	4	12	Son-Yellow-stone 1-A	Long Beach
Sovereign Oil Corp.	19	4	12	2	Long Beach
Sovereign Oil Corp.	19	4	12	3	Long Beach
Sovereign Oil Corp.	20	4	12	4	Long Beach
The Texas Co.	19	4	12	Foster One 4	Long Beach
The Texas Co.	29	4	12	Goddard 2	Long Beach
The Texas Co.	19	4	12	Harlow 5-A	Long Beach
The Texas Co.	29	4	12	McDavid 4	Long Beach
The Texas Co.	29	4	12	Perrin 2	Long Beach
Turner-Harris Oil Corp.	29	4	12	2	Long Beach
Union Oil Co.	30	4	12	Long Beach Comm. 21	Long Beach
Union Oil Co.	30	4	12	Long Beach Comm. 22	Long Beach
Universal Consolidated Oil Co.	28	4	12	French 1	Long Beach
Universal Consolidated Oil Co.	28	4	12	Judson 2	Long Beach
Western Oil and Refining Co. and Olympic Refining Co.	19	4	12	14	Long Beach
Woolner Oil Corp.	19	4	12	Signal Hill 4	Long Beach
Standard Oil Co.	3	2	12	Whitehead Comm. 2	Montebello
Associated Oil Co.	34	2	14	Pacific Southwest 1	Potrero

OIL FIELD DEVELOPMENT OPERATIONS—Continued

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
Associated Oil Co.	35	2	14	Voorhes 1	Potrero
Union Oil Co.	17	3	13	Chandler 3	Rosecrans
The Texas Co.	6	3	11	Matern Two 7	Sante Fe Springs
Union Oil Co.	6	3	11	Bell 28	Santa Fe Springs
Marland Oil Co.	11	5	12	Bixby 21	Seal Beach
W. W. Bush	16	4	14	2	Torrance
C. C. M. O. Co.	10	4	14	Torrance 92	Torrance
Russell Oil Co.	25	3	17	2	
Shell Co.	4	2	15	Mission 2	
World Petroleum Corp.	23	3	12	Bellflower 11	
MADERA COUNTY:					
Los Angeles-Madera County Syn. (Rex B. Goodcell, Trustee)	21	10	17	M. and L. 2	
NAPA COUNTY:					
Northern California Petroleum Co.	12	4	5	1	
ORANGE COUNTY:					
Brea Canon Oil Co.	2	3	10	44	Brea Olinda
Shell Co.	2	3	10	Orange 17	Brea Olinda
Union Oil Co.	2	3	10	Naranjal 13	Brea Olinda
Petroleum Securities Co.	24	3	11	McNally 1	Coyote Hills
Standard Oil Co.	13	3	11	Emery 41	Coyote Hills
Standard Oil Co.	24	3	11	Emery 42	Coyote Hills
Bell of Montebello Oil Co.	2	6	11	8	Huntington Beach
Commonwealth Oil Co.	11	6	11	3	Huntington Beach
Garliepp and Mack	11	6	11	3	Huntington Beach
Sam N. Lewis	10	6	11	Van 1	Huntington Beach
W. D. McKoy	11	6	11	1	Huntington Beach
Standard Oil Co.	34	5	11	Bolsa 36	Huntington Beach
Standard Oil Co.	34	5	11	Bolsa 37	Huntington Beach
Standard Oil Co.	34	5	11	Bolsa 38	Huntington Beach
Standard Oil Co.	10	6	11	P. E. 16	Huntington Beach
Continental Oil Co.	33	3	9	Pyne 7	Richfield
George W. Johnson	28	3	9	Davenport Comm. 1	Richfield
Nugent Drilling Co.	27	3	9	3	Richfield
Union Oil Co.	33	3	9	Stern 13	Richfield
C. R. McCollom and W. H. Taylor	13	5	11	Sterling Price 1	
RIVERSIDE COUNTY:					
Hall, Holtz and Hennessy, Trustees	23	7	3	Watt 1	
SAN BENITO COUNTY:					
Associates Petroleum Corp.	5	19	10	2	
J. H. Hadley, Jr.	5	17	12	1	
SAN DIEGO COUNTY:					
James H. Bach	8	15	3	1	
SAN LUIS OBISPO COUNTY:					
Union Oil Co.	12	32	14	Huasna-Chandler 1	
SAN MATEO COUNTY:					
Shell Co.	8	6	5	Cowell 2	
Skyline Oil and Refining Corp.	15	6	5	1	
SANTA BARBARA COUNTY:					
Palmer Union Oil Co.	30	9	32	Stendel 10	Cat Canyon
Palmer Union Oil Co.	30	9	32	Stendel 20	Cat Canyon
Barnsdall Oil Co.	--	4	29	Luton-Bell 1	
SANTA CLARA COUNTY:					
Continental Oil Co.	1	12	3	3	Sargent
SOLANO COUNTY:					
H. Rambke	18	7	1	1	

OIL FIELD DEVELOPMENT OPERATIONS—Continued

Company	Sec.	Twp.	Range	Well No.	Field
VENTURA COUNTY:					
Continental Oil Co.	21	4	22	Fox 1-M	Ojai
Continental Oil Co.	22	4	22	Thompson 1-M	Ojai
Bankline Oil Co.	7	3	24	1	Rincon
C. C. M. O. Co.	17	3	24	Hobson B-3	Rincon
Elmer Co.	6	3	24	Elmer 3	Rincon
General Petroleum Co.	7	3	24	Oland 1	Rincon
General Petroleum Co.	8	3	24	Tomson 2	Rincon
General Petroleum Co.	8	3	24	Tomson 4	Rincon
Italo Petroleum Corp.	7	3	24	Hickey 1	Rincon
Petroleum Exploration Co.	7	3	24	Hickey 1	Rincon
Southern Pacific Land Co.	8	3	24	4	Rincon
Southern Pacific Land Co.	8	3	24	5	Rincon
Wilshire Oil Co., Inc.	7	3	24	Hickey 1	Rincon
Wasibi Oil Co.	34	5	19	B	Sespe
Oak Ridge Oil Co.	18	3	20	Willard 24	South Mountain
Associated Oil Co.	22	3	23	Hartman 12	Ventura
Associated Oil Co.	22	3	23	Lloyd 36	Ventura
Associated Oil Co.	27	3	23	Lloyd 56	Ventura
Petroleum Securities Co.	28	3	23	Orton 8	Ventura
Petroleum Securities Co.	28	3	23	Orton 9	Ventura
Petroleum Securities Co.	28	3	23	Orton 10	Ventura
Shell Co.	28	3	23	Edison 24	Ventura
Shell Co.	28	3	23	Edison 25	Ventura
Shell Co.	28	3	23	Gosnell 27	Ventura
Shell Co.	28	3	23	Gosnell 28	Ventura
Shell Co.	29	3	23	Taylor 23	Ventura
Shell Co.	28	3	23	Taylor 27	Ventura
Shell Co.	27	2	22	Grubb 1	
Shell Co.	22	2	22	Lambert 1	
Shell Co.	27	2	22	Snodgrass 1	
Standard Oil Co.	15	2	22	Saticoy-Citrus 4	
Standard Oil Co.	10	2	22	Schneider 1	
Standard Oil Co.	11	2	22	Vanoni 1	

SPECIAL ARTICLES

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff and others are published in each number of MINING IN CALIFORNIA.

These special articles cover a wide range of subjects both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

QUARTZ CRYSTALS

The following information regarding quartz for use of the United States Navy has been supplied by the Naval Research Laboratory, Bellevue, Anacostia, D. C.

Naval headquarters in San Francisco is at 100 Harrison Street; Captain McDowell in charge, to whom samples may be submitted.

The U. S. Navy needs tons of quartz crystals and will pay $6,000 per ton f.o.b. San Francisco for suitable crystals.

The Naval Research Laboratory, Anacostia, D. C., will be glad to examine and report on sample crystals sent there for inspection. Quartz crystals must comply with certain requirements regarding weight and quality; otherwise they are useless. Careful reading of the requirements outlined below may save useless trouble and correspondence.

(a) Crystals must be clear. In other words, you should be able to look through them the same as you can a piece of good plate glass and not notice any imperfections therein.

(b) Crystals must be single crystals and must weigh at least 2 pounds each. Two to thirty pounds is the preferable size desired, although larger crystals will be accepted. Growth lines must be in evidence on at least 2 side faces.

(c) Imperfections that make quartz useless are (1) fractures, which look like internal cracks in the crystal, and (2) inclusions of foreign substances. The latter generally exhibits itself by making the crystal opaque or milky rather than clear, and the microscope shows this is due to minute bubbles of some included substance such as air or water. This defect often shows itself in the form of fleecy clouds.

As a matter of general information it might be mentioned a quartz crystal is parallel-sided with 6 faces topped by a 6-sided apex and consists of one crystal ONLY, not several small crystals grown together in a lump. On these side faces are usually found growth lines, small ridges perpendicular to the edges. Occasional fractures are to be expected and would not cause rejection of crystal unless present in considerable numbers. Fractures result from injury to the crystal at some time subsequent to its formation either by earth movements or other causes, while inclusions of foreign substances occur at the time the crystal is being formed. Perfect crystals are not required; fragments of suitable size and quality showing at least parts of 2 natural side faces with growth lines thereon are entirely satisfactory.

There are two other kinds of quartz crystals which the Navy can use. One of these is known as smoky quartz, as this results from an uniform color throughout the quartz and is not caused by inclusions previously mentioned. The only restriction regarding smoky quartz is that the color can not be so dense as to prohibit visual inspection for fractures or inclusions by use of a strong light. The other kind of quartz is known as limpid quartz. This generally consists of big fragments of clear glass-like quartz without any natural faces. Its use necessitates considerable work to determine the optical axis, hence its value is less than that of crystal quartz.

Quartz is used for controlling the frequency of radio transmitters and therefore has a military significance. The main source of crystal supply at present is Brazil, but it is believed that domestic sources exist if they can be found and developed. It is further believed that except for occasional crystals of the required size the probable location in this country of crystal deposits of sufficient size to be of value will be found in the Mother Lode in California and in northern Nevada. Crystals of the required characteristics have been obtained in Calaveras County, California.

In using these crystals the Navy avails itself of the growth lines as an indication of the direction in which the optical axis lies. This is generally along the length of the crystal. Crystals are then cut up into slabs about 1″ thick perpendicular to the axis. After optical examination the slabs are cut into strips anywhere from 3/100 to 2/10 inches thick, which are further cut up into pieces about 1″ long, so that the final product is a small slab of perfect quartz about 1″ square by say 1/10 inch thick. There can not be the slightest imperfection in this final piece; hence the crystal must be nearly clear and perfect if it is to be divided up into such small units and have them be of any value.

The Navy specifications require Brazilian quartz shall be clear and free from fractures. To develop a domestic source of supply the Navy is willing to pay a differential over the cost of Brazilian quartz and to make the further allowance that crystals, in large part clear but partly defective at one end, will be accepted and paid for on the basis of approximate weight of suitable part. In doing this the Navy incurs the expense of paying freight on and cutting out the unsuitable material. As it is also necessary that the crystal be free from twinning and this can only be ascertained by optical examination after the crystal has been sawed up. The Navy assumes the further risk of finding crystals otherwise acceptable entirely unsatisfactory when the optical examination is made.

NOTES ON THE LAW OF MINING LOCATIONS AND LANDS OPEN TO MINING IN CALIFORNIA [1]

By C. A. Logan

One of the most frequent subjects of inquiry at the offices of this Bureau is the matter of mining law, as applied to the proper procedure for locating claims and holding same. The State Mining Bureau has published various bulletins on the subject, but stock of these is at present exhausted. The following notes are intended to make available for reference the main points of federal and state laws prescribing the methods to be followed in taking up mining claims on vacant public lands within this state, with some notes on lands available for mining.

These notes are based in the main upon those parts of the statutes which are of direct interest to the prospector who wants to make his location legal, and the writer has tried to avoid any technical or theoretical considerations not directly touching upon these details. Therefore no mention is made of the extralateral right nor of the other legal sinuosities that may arise. At the same time, it is believed that if the simple points mentioned are carefully attended to in making out the location notice and laying out the claim, the locator will avoid most of the dangers and vexations that later befall him when his location is faulty. The subject of mining law is a complex one, of such scope as to call for extended study by anyone who would master it. For a complete reference book on the subject the reader should consult Lindley [2] or one of the other standard authorities. An excellent reference book, much smaller but covering practical points, is Wilson's Mining Laws; also Ricketts' 'Manual of American Mining Law.'

In preparing the following notes the writer has drawn freely upon lecture notes taken while attending a course of lectures delivered at the University of California by William Colby, mining attorney, to whom acknowledgment is here made. Lindley on Mines has also been used, as have numerous federal and state circulars dealing with the details concerned. Cases could be cited for most of the points covered.

Summarizing the requirements of the United States and California statutes, as applied to lode mining locations upon vacant government land within this state, it will be noted that the following indispensable requirements must be met in order to fully protect the interests of the claimant:

(1) Discovery, the most vital factor, which must precede location or any rights thereunder. (Federal and state requirement.)

(2) The location must be marked upon the ground so that the boundaries of the claim or claims can be readily traced by anyone coming on the property and desiring to know what land is claimed. (Federal and state requirement.)

[1] Reprinted from the July chapter of Report XX, 1924 (out of print), on account of the continued request for information on this subject.

[2] Lindley on Mines. A treatise on the American law relating to mines and mineral land, by Curtis H. Lindley, San Francisco, 1914.

(3) Where the state or district mining law requires that a record of the location be kept, the federal statute requires that this record must contain the following details:

1. The name of the lode or claim.
2. The name of the locator or locators.
3. The number of linear feet claimed in length along the course of the vein, each way from the point of discovery, with the width on each side of the center of the claim, and the general course of the vein or lode, as near as may be.
4. The date of location.
5. Such a description of the claim by reference to some natural object, or permanent monument, as will identify the claim located.

The state law incorporates these provisions of the federal statute, word for word.

(4) The state law (see paragraph 1426, *post*) specifies that a location notice must be posted upon the claim at the point where the discovery of valuable mineral is made, and that this notice must contain the information called for under the five divisions of the last paragraph.

(5) The state law also requires that a copy of the above notice must be filed for record within 30 days of the date of posting, in the office of the county recorder of the county in which the claim is situated.

Differing from the lode location requirements, the state laws regarding placer claims specify that where placer claims are taken by location according to the subdivisions of the public land survey and where the location notice specifies the legal subdivision of section, township and range, the boundaries of a claim so located and described need not be staked nor monumented. A prudent locator will, however, always stake his claim and when describing the same as above mentioned will ordinarily need at least an approximate survey to be sure the notice properly describes the land intended to be claimed.

Importance of Discovery in Initiating the Locator's Rights

Upon a lode claim, discovery is defined as the actual finding of *ore in place,* not as float. The value of the ore is not a controlling factor, but the test is, according to Colby,[1] "would a prudent man be justified in spending money to develop it?" (See *Brook* vs. *Justice Mining Co.* 58 Fed., p. 120.)

While it has been remarked that the order in which the various steps required to complete a valid location is not necessarily invariable, it may be said in general that the claim is not safely secured against rival locators until a valid discovery of mineral has been made. Court decisions on the point have been at variance. In this state the first locator may get an injunction forbidding the second from coming upon the claim, pending decision of the matter. This would apparently give the first locator an advantage in the "race of diligence" to reach the mineral first. Prior possession is an important factor.

Where there is a contested area claimed by two or more locators, the senior locator might make a valid discovery of mineral in the contested area, but the junior locator or locators could not ordinarily

[1] W. E. Colby, attorney at law and lecturer on Mining Law, University of California.

do so, unless the senior locator so far forgot his own interests as to fail to take proper steps to prevent it. This point arose in a recent case decided by the local land office.

Neither the federal law nor the California statutes require that any particular form of opening or any certain amount of work be done to complete a valid discovery.

Marking the Claim, and the Shape of Claim

The state law does not specify any particular manner of marking claim boundaries. The U. S. General Land Office regulations specify a post or stone monument at each corner and a post, stake or board at the discovery point. While it is not absolutely necessary that such markers be maintained by the locator, it of course is advisable to keep such markers in place both for his own protection and as a matter of justice to other prospectors who may be seeking minerals in the same locality.

The ideal quartz mining claim, which will give the largest area allowed by the federal statute and the fullest exercise of the extralateral right, is 1500 feet long by 600 feet wide, and is a right-angled parallelogram with the side lines parallel to the lode and the end lines crossing the lode at right angles. The claim can not extend more than 300 feet on each side of the center of the vein, measured at right angles to the side lines. The end lines must be parallel straight lines, but the side lines need not be either parallel or straight, and if the vein is sinuous, the side lines should follow it. Care should be exercised to see that the claim is so taken that the vein does not depart from the claim through a side line, as this would result in greatly cutting down the length of the claim and would curtail the exercise of the extralateral right, possibly with very serious loss to the locator. The law will give the locator only so much of the vein along the strike as he has of the apex within the boundaries of his claim. The end lines do not have to be of equal length and do not have to cross the vein at any particular angle. The possession of the apex within the boundaries of the claim is essential to the enjoyment of the extralateral right downward on the dip of the vein.

Form of Location Notice. Posting the Notice

Neither the Federal nor the California statutes require any particular *form* that need be followed in writing the location notice, and it is not necessary to use any particular printed blank, although the blank is convenient and often safer as its use insures that attention will be called to the information required, preventing the omission of some important detail. Suggested forms that may be used as models in writing out either lode or placer location notices are shown herewith.

The courts as a rule have been liberal in dealing with the question of form of location notices, and as a rule inquire rather into the good faith of the locator than into the form of his notice. The notice must contain the details given under the five headings of paragraph 3 under requirements. The signatures of witnesses on the location notice naturally strengthen it in case of dispute, although not specifically required in California, and if it happened that two or more rival locations were attempted upon the same claim on the same day, it

would prove of value to show the hour of the posting. If the position of the claim with regard to section, township and range is known this should be shown. The old mining districts with their district recorders have become extinct, with possibly one exception, in this state.

The location notice must be posted at a conspicuous place on the claim, as it is intended to be a notice to all the world that the ground claimed has been removed from the public domain for mining purposes. It will be noted that the state law regarding placer locations says the location notice may be posted upon a tree, rock in place, stone, post or monument, and does not specifically mention that it is to be put at the point of discovery. As a matter of prudence, but not specifically required by law, the location notice should be maintained upon the claim. The test of the sufficiency of a location notice would be to take the notice as posted and recorded, and in the absence of stakes or lines, trace out the boundaries of the claim from the recorded description.

Assessment Work. Proof of Labor. Delinquent Colocator

The annual assessment year now begins at noon, July first. The locator of a claim has one full year, beginning at noon of July first, next following the date of his location, during which to perform the first year's assessment work. One hundred dollars worth of labor must be done or improvements made upon each claim per annum. The test of the validity of assessment work done is: Does it facilitate the extraction of valuable mineral from the claim?

Three classes of work may be valid as assessment work or for credit toward the $500 requirement for patent. (1) Work within the boundaries of the claim for the purpose of actually developing the mineral deposits in the claim. This may consist of excavation, drilling, erection of works *for mining* or placing of machinery for use *in mining,* the development of orebodies, or the actual extraction of mineral. A quartz mill does not satisfy the assessment requirement on a lode claim, but a dredger does on a placer claim. (2) Work on a group of claims for the joint benefit of all, by virtue of the community of interest between colocators or an agreement between locators of adjoining claims. (3) Work outside of a claim or group of claims, when such work tends to facilitate the extraction of valuable mineral from the claim or claims. This includes tunnels for the development of deposits above the line of tunnel; roads and trails, and the making of flumes and ditches to conduct water to placer mining claims.

As regards requirements of assessment work, an association placer, taken up as a unit by colocators, may be considered as a single claim, though containing more than 20 acres. All the assessment work for a group of adjoining claims may be done upon one claim if conclusively shown to benefit the entire group, and if $100 is expended for each claim. The term "group of claims" as here used, is applied to a number of claims taken up by colocators and regarding which it was understood at the time of location that they were being so taken.

The proof of labor is an affidavit made by the owner of the claim or by some one in his behalf, acquainted with the facts, setting forth that during the year in question, certain amounts (not less than $100 for each claim) have been expended for labor upon or for improvements upon the claim named. This affidavit must be filed for record

in the office of the county recorder of the county in which the claim or claims are situated, within 30 days after July first each year (except as before mentioned for the fraction of a year between the date of location and the next July first.)

The California statute (see paragraph 1426*s* herewith) provides that the failure or neglect of any locator of a mining claim to perform assessment work as specified in the United States statutes shall disqualify such locator from relocating such claim or any part thereof within three years of the date of his original location, and any such attempted relocation is declared void. To prevent location of such a claim by others, such a delinquent locator would have to go upon the claim and prosecute his work to completion.

The United States statutes (section 2324 herewith) provide the general manner in which one locator of a claim who keeps up the assessment work on the claim may obtain relief from his fellow locators who fail to pay their shares of such expense. The California statute (paragraph 1426*o* herewith) sets forth in detail the procedure to be followed in serving or publishing the notice to the delinquent party, and the steps the delinquent may take to protect his interests within the 90-day period allowed him. Failure of such delinquent coowner to meet his share of the cost of assessment work within 90 days after personal service of notice, or within 90 days after the beginning of weekly publication of such notice of delinquency in the newspaper published nearest the claim, results in the delinquent's interest in the claim becoming the property of the owner or coowners who have paid for the assessment work.

Extent of the Right to Locate Claims and Those Eligible to Make Locations

Neither the United States nor California mining laws limit the number of lode or placer claims that may be located by one person. An individual may locate as many claims for mining as he is able to find separate valid discoveries of mineral for, the law requiring that such a discovery be made for each claim within the boundaries of the claim.

A single locator may not locate more than 20 acres of placer mining ground in one "claim," but an association of locators may take up an association placer, containing not more than 20 acres for each locator, and not more than 160 acres in a single such association "claim" by a minimum of eight persons.

Women and minor children have equal rights with others in locating mining claims.

What May Be Located as Mineral

It seems strange that dispute should arise as to whether or not a substance is mineral. Yet it is of recent record that the question of the mineral character has been raised in the case of such an important mineral as petroleum, by parties who were interested in having oil lands declared nonmineral. Besides the metals, which are minerals beyond dispute, the following substances have been held to be mineral, according to the decision of the United States Land Office and the courts: Alum, amber, asphaltum (see petroleum), borax, brick clay, building stone, carbonates (of soda, etc.), cement (gypsum), china clay, high-grade pottery clay, etc.; coal (special laws govern), diamonds and other precious stones, gravel, guano, gypsum, kaolin, limestone, marble,

mica, natural gas (see petroleum), nitrates, onyx, petroleum (special withdrawals), potash (special legislation), phosphates (special legislation), salt (special law), sand, sandstone, slate, soda (nitrate and carbonate), stone of special commercial value, sulphur and umber.

There is sometimes question as to whether or not a certain deposit should be located as placer or lode. In such a case and in the absence of sufficient technical knowledge or lack of advice, there is nothing to prevent the location both as lode and placer, pending final determination of the character of deposit. In locating placer mining ground in which lodes occur, special attention should be paid to the provisions of law governing such cases. The Revised Statutes of the United States, title 32, chapter 6, section 2333, cover this point. It is provided that lodes known to exist within a placer claim for which patent is being sought must be described and separately purchased, and if the placer claimant, knowing of the presence of such lodes, fails to mention them in his application for placer patent, his failure to so do shall be construed as a declaration that he has no right of possession of such lodes. Quartz claims with a width of fifty feet may be taken up on *known* quartz veins within the boundaries of placer claims, but the complications that are apt to arise when a second party attempts to make such a location against the wishes of a hostile placer claimant, on whose claim he must trespass to make the lode location, are such as to call for the exercise of care. When a lode exists in a placer claim, but has not been discovered previous to the issuance of placer patent, the placer patent includes the lode or lodes that may be later discovered.

LANDS OPEN TO LOCATION FOR MINING

Title 32, chapter 6, section 2319, Revised Statutes of the United States, provides that all valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are declared to be free and open to exploration and purchase, and the lands in which they are found to occupation and purchase, by citizens of the United States, and those who have declared their intention to become such. During recent years there have been many withdrawals of mineral lands and much special legislation regarding deposits of certain minerals. In fact there has been such a tendency ever since 1866, when a bill was presented in congress providing for the leasing of western mining lands on royalty. This was defeated by the western mining interests who substituted the mining law of 1866, which was later superseded by the enactment of 1872.

Under present conditions, lands known to contain coal, petroleum, oil shale, potash, phosphate, sodium salts (except common salt, on which one claim only may be located (can not be located and patented under the regular lode or placer laws but are obtainable under lease, subject to the control of the Secretary of the Interior. Land in certain national parks and national monuments is also not subject to entry. There have also been certain withdrawals of public lands for powersite and kindred use, with a Federal Power Commission exercising certain powers of disposal, and with entries for other purposes not allowed. The status of these powersite withdrawals, as affecting the miner's rights, is somewhat uncertain, and whether or not he could success-

fully prosecute a claim to land taken up under the mining law within such power reserves is debatable, as the United States Land Office regulations seem to imply some leeway, depending on circumstances in each case. Certain Indian reservations in the western states, including a few in California, which have heretofore not been open to exploration for mining, have been thrown open for prospecting in the last few years, and rules and regulations have been set up under which such reservation lands may be mined. These rules are rather onerous, and would deter the ordinary small prospector. Among the requirements for working such lands is one calling for a bond to be executed in favor of the government for $500 or more on each lease, depending on acreage, and the payment of annual rental of 25 cents and upward per acre, as well as payment of royalty on any ores or minerals sold. This reservation land can be mined only for metalliferous minerals. Claims are to be taken up according to the United States mining laws, and annual assessment work has to be done in addition to having a survey made and fulfilling all the other terms mentioned. Information regarding mining such Indian reservation lands can be had from the several superintendents of the reservations. The leases are issued by the Secretary of the Interior, through the local superintendents.

Vacant government land within the numerous national forests of this state is open to location and patent for mining purposes to the same extent as other vacant unreserved government land. The total area of the national forests in California is about 19,000,000 acres and the lands included lie for the most part in the mountainous eastern part of the state, away from the settled portions and in general above an elevation of 2500 feet. Maps of the different forests may be obtained from the various local offices of the United States Forest Service or from their office in the Ferry Building, San Francisco. There is, of course, a great deal of patented land within the boundaries of these forests, which was patented before the forest reserve was set aside, and the local forest service employes should be consulted about such lands if in doubt.

The total acreage of unappropriated, unreserved government land in California on July 1, 1927, was 20,610,877 acres. The figures are from circulars of the General Land Office. The United States government maintains local land offices at Sacramento and Los Angeles, where information can be had regarding vacant government lands or steps taken to make entry for patent.

Mention should also be made here of the land included in stock-raising homesteads, patented under the act of December 29, 1916. Under the provisions of this act the Secretary of the Interior was authorized to designate unreserved public lands in the public-land states, of which California is one, as stock-raising lands. This does not refer to lands within the national forests. Under the terms of section 9 of this act, it is provided that all patents issued thereunder "shall contain a reservation to the United States of all coal and other minerals in the lands so entered and patented, together with the right to prospect for, mine and remove the same"; the same section also provides that any person qualified to locate and enter the coal or other mineral deposits, or having the right to mine and remove the same under the laws of the United States, shall have the right at all times to enter upon the lands entered or patented under the act for the

purpose of prospecting for the coal or other mineral therein. But he shall not injure or damage or destroy the permanent improvements of the entryman or patentee and shall be liable to and shall compensate the entryman or patentee for all damages to the crops on the land by reason of such prospecting. The prospector is required to do one of three things: (1) he must obtain the written consent or waiver of the homestead entryman or patentee; (2) he must pay damages to crops or other tangible improvements if and when an agreement is reached as to the amount of such damages; or, (3) in lieu of either of the foregoing provisions, he must execute a good and sufficient bond for not less than $1,000 in favor of the United States for the use and benefit of the homesteader, to secure the payment of such damages. Subject to these provisions, he may occupy as much of the surface of such a homestead as may be reasonably necessary for the mining and removal of the mineral deposits within his mining claims. Where the mining location was made prior to the entry for homestead, the mining claimant must exercise diligence in filing a protest in the local land office of the district in which his claim is, setting forth the facts regarding his mining claim and the mineral character of the land, otherwise he is apt to awake too late to the fact that his claim has been given to the homesteader.

This act has been the cause of considerable complaint, and appears in some particulars to contradict itself. While it expressly reserves the mineral resources in such lands and affirms the right of qualified persons to enter the land for the purpose of prospecting for and mining mineral deposits, it also sets up restrictions which tend to discourage the prospector and which are discriminatory in favor of the homesteader.

Before passing from the subject of vacant public lands and the rights of the prospector thereon, it can not be too forcibly emphasized that, having once located a mining claim with the intention of holding and working the same, the only safe course for the locator to follow is to complete in the shortest possible time the $500 worth of labor or improvements required for patent, to have the necessary survey made, and to press his application for patent with all diligence. Under the present laws, the miner has no means of making his claim known officially to the United States Land Office until he has completed the above work and has sought a patent, or until adverse claimants make it necessary for him to file a protest. If he spends only part of the year in the district where his claims are, it may happen that the published notice of application for patent by adverse claimants may escape his attention, and patent may be given to the adverse claimant for the land within his mining location, in spite of the fact that he may have fulfilled all the requirements of law to hold his claim and may be actually developing the claim at the time. This state of affairs is possible because of the failure of the United States Land Office to examine the character of lands for which patent is sought unless a protest is made.

STATE LANDS OPEN TO MINING

Besides the vacant government lands, there are within the State of California about 750,000 acres of land belonging to the state. This

consists chiefly of sections numbered 16 and 36, thus far unsold, in each township, except where exchanges have been made or are in course of being made, with the federal government for administrative reasons. Much of this land, like the vacant government lands, is either mountainous or desert land having little value as a rule for agriculture but with mineral possibilities in many cases. The counties containing large acreages of this state land are as follows: San Bernardino, about 250,000 acres; Inyo, about 150,000 acres; Riverside, 50,000 acres; Lassen, about 60,000 acres; Modoc, about 30,000 acres; Imperial, 30,000 acres, with lesser amounts in other counties, there being some of this land in about forty counties. This land is sold subject to a reservation of one-sixteenth of all minerals ever found therein to the state. Unsold state lands may be prospected, and may be leased for mining purposes, under regulations prescribed by the State Surveyor General, Capitol Building, Sacramento, and requests for information regarding the location of such lands and regulations governing the sale or lease of same should be addressed to him.

The records and reports of the State Mining Bureau, as well as the various government reports on file in the offices of the Bureau, may be referred to for information about the geology and mineral resources of the entire state, and these records will often be found useful in giving the prospector a general idea of the character and mineral possibilities of the district where he intends to search for minerals.

OTHER LAWS AFFECTING THE MINING LOCATOR

Hydraulic Mining

Placer mining by the hydraulic process on streams which drain into any tributary of a navigable river in this state must be carried on under regulations laid down by the California Debris Commission, made up of three officers of the Corps of Engineers, United States Army. For information regarding steps to be taken in order to obtain written permission for hydraulic mining on the watersheds of the navigable rivers, inquiries should be addressed to California Debris Commission, 85 Second street, San Francisco. The above restrictions do not apply on the Trinity, Klamath, Salmon, Smith or other rivers of the northern part of the state which are not navigable, but do cover work on any tributary of the Sacramento or San Joaquin or Feather rivers, which means all that part of the state whose streams flow into the great central valley.

Safety Regulations

The Industrial Accident Commission of California is charged with the framing and enforcement of safety orders and rules for the protection of mine workers, and inquiries on any phase of this subject should be addressed to the commission at the State Building, Civic Center, San Francisco.

Use of Water for Mining

The miner often wishes to use water that flows through or near by his claims. While the riparian right will permit the use by such an owner of water flowing through the claim where it is used, it is necessary to file an appropriation when desiring to make use of water where

the diversion point is outside of the claim. For the formalities to be observed in making an appropriation, the inquirer should address State Division of Water Rights, Department of Public Works, Sacramento. Water must be put to beneficial use as soon as possible, to hold it.

Use of Timber on Unpatented Mining Claims

The law permits a locator to use for mining or other necessities *on the claim or claims concerned,* any timber growing thereon, but such timber can not be cut down and taken off the claim for other uses.

Use of Mining Claims for Other Purposes

A mining claim can not be located as such and then used for other purposes such as a site for a store or summer resort, and such an attempted use would invalidate the location.

UNITED STATES MINING STATUTES

Title XXXII, Chapter 6, Revised Statutes

SEC. 2319. All valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are hereby declared to be free and open to exploration and purchase, and the lands in which they are found to occupation and purchase, by citizens of the United States and those who have declared their intention to become such, under regulations prescribed by law, and according to the local customs or rules of miners in the several mining districts, so far as the same are applicable and not inconsistent with the laws of the United States.

Lode Claims

SEC. 2320. Mining claims upon veins or lodes of quartz or other rock in place bearing gold, silver, cinnabar, lead, tin, copper, or other valuable deposits, heretofore located, shall be governed as to length along the vein or lode by the customs, regulations, and laws in force at the date of their location. A mining claim located after the tenth day of May, eighteen hundred and seventy-two, whether located by one or more persons, may equal, but shall not exceed, one thousand five hundred feet in length along the vein or lode; but no location of a mining claim shall be made until the discovery of the vein or lode within the limits of the claim located. No claim shall extend more than three hundred feet on each side of the middle of the vein at the surface, nor shall any claim be limited by any mining regulation to less than twenty-five feet on each side of the middle of the vein at the surface, except where adverse rights existing on the tenth day of May, eighteen hundred and seventy-two, render such limitation necessary. The end lines of each claim shall be parallel to each other.

Citizenship

SEC. 2321. Proof of citizenship, under this chapter, may consist, in the case of an individual, of his own affidavit thereof; in the case of an association of persons unincorporated, of the affidavit of their authorized agent, made on his own knowledge, or upon information and belief; and in the case of a corporation organized under the laws of the United States, or of any state or territory thereof, by the filing of a certified copy of their charter or certificate of incorporation.

This is supplemented by an act of April 26, 1882, which provides:

"That applicants for mineral patents, if residing beyond the limits of the district wherein the claim is situated, may make any oath or affidavit required for proof of citizenship before the clerk of any court of record, or before any notary public of any state or territory." (22 Stats. at Large, p. 49, Chap. 106.)

Extralateral Rights

SEC. 2322. The locators of all mining locations heretofore made or which shall hereafter be made, on any mineral vein, lode, or ledge, situated on the public domain, their heirs and assigns, where no adverse claims exist on the tenth day of May, eighteen hundred and seventy-two, so long as they comply with the laws of the United States, and with state, territorial and local regulations not in conflict with the laws of the United States governing their possessory title, shall have the exclusive right of possession and enjoyment of all the surface included within the lines of their locations, and of all veins, lodes and ledges throughout their entire depth, the top or apex of which lies inside of such surface lines extended downward vertically, although such veins, lodes, or ledges may so far depart from a perpendicular in their course downward as to extend outside the vertical side lines of such surface locations. But their right of possession to such outside parts of such veins or ledges shall be confined to such portions thereof as lie between vertical planes drawn downward as above described through the end lines of their locations, so continued in their own direction that such planes will intersect such exterior parts of such veins or ledges. And nothing in this section shall authorize the locator or possessor of a vein, or lode which extends in its downward course beyond the vertical lines of his claim, to enter upon the surface of a claim owned or possessed by another.

Tunnel Claims

SEC. 2323. Where a tunnel is run for the development of a vein or lode, or for the discovery of mines, the owners of such tunnel shall have the right of possession

of all veins or lodes within three thousand feet from the face of such tunnel on the line thereof, not previously known to exist, discovered in such tunnel, to the same extent as if discovered from the surface and locations on the line of such tunnel of veins or lodes not appearing on the surface, made by other parties after the commencement of the tunnel, and while the same is being prosecuted with reasonable diligence, shall be invalid, but failure to prosecute the work on the tunnel for six months shall be considered as an abandonment of the right to all undiscovered veins on the line of such tunnel.

Recording and Annual Assessments

SEC. 2324. The miners of each mining district may make regulations not in conflict with the laws of the United States, or with the laws of the state or territory in which the district is situated, governing the location, manner of recording, amount of work necessary to hold possession of a mining claim, subject to the following requirements: The location must be distinctly marked on the ground so that its boundaries can be readily traced. All records of mining claims hereafter made shall contain the name or names of the locators, the date of the location, and such a description of the claim or claims located by reference to some natural object or permanent monument as will identify the claim. On each claim located after the tenth day of May, eighteen hundred and seventy-two, and until a patent has been issued therefor, not less than one hundred dollars' worth of labor shall be performed or improvements made during each year.

Be it enacted by the senate and house of representatives of the United States of America in congress assembled, that section two thousand, three hundred and twenty-four of the Revised Statutes be, and the same is hereby, amended so that where a person or company has or may run a tunnel for the purpose of developing a lode or lodes, owned by said person or company, the money so expended in said tunnel shall be taken and considered as expended on said lode or lodes, whether located prior to or since the passage of said act; and such person or company shall not be required to perform work on the surface of said lode or lodes in order to hold the same as required by said act. (18 Stats. at Large, page 315, Chap. 41.)

Patents

Section 2325 of the federal statutes provides that after $500 has been expended on a mining claim in work or improvements, a patent can be applied for, upon the claim being surveyed by a United States mineral surveyor, and by the payment of $5 per acre for the land to the United States government.

PLACERS

SEC. 2329. Claims usually called "placers" including all forms of deposit, excepting veins of quartz, or other rock in place, shall be subject to entry and patent, under like circumstances and conditions, and upon similar proceedings, as are provided for vein or lode claims; but where the lands have been previously surveyed by the United States, the entry in its exterior limits shall conform to the legal subdivisions of the public lands.

Areas of Placer Claims

SEC. 2330. Legal subdivisions of forty acres may be subdivided into ten-acre tracts, and two or more persons, or associations of persons, having contiguous claims of any size, although such claims may be less than ten acres each, may make joint entry thereof; but no location of a placer claim, made after the ninth day of July, eighteen hundred and seventy, shall exceed one hundred and sixty acres for any one person or association of persons, which location shall conform to the United States surveys; and nothing in this section contained shall defeat or impair any bona fide preemption or homestead claim upon agricultural lands, or authorize the sale of the improvements of any bona fide settler to any purchaser.

SEC. 2331. Where placer claims are upon surveyed lands, and conform to legal subdivisions, no further survey or plat shall be required, and all placer mining claims located after the tenth day of May, eighteen hundred and seventy-two, shall conform as near as practicable with the United States system of public lands surveys, and the rectangular subdivisions of such surveys, and no such location shall include more than twenty acres for each individual claimant; but where placer claims can not be conformed to legal subdivisions, survey and plat shall be made as on unsurveyed

lands; and where by the segregation of mineral land in any legal subdivision a quantity of agricultural land less than forty acres remains, such fractional portion of agricultural land may be entered by any party qualified by law, for homestead or preemption purposes.

Placer Boundaries

SEC. 2333. Where the same person, association, or corporation is in possession of a placer claim, and also a vein or lode included within the boundaries thereof, application shall be made for a patent for the placer claim, with the statement that it includes such vein or lode, and in such case a patent shall issue for the placer claim, subject to the provisions of this chapter, including such vein or lode upon the payment of five dollars per acre for such vein or lode claim, and twenty-five feet of surface on each side thereof. The remainder of the placer claim, or any placer claim not embracing any vein or lode claim, shall be paid for at the rate of two dollars and fifty cents per acre, together with all costs of proceedings; and where a vein or lode, such as is described in section twenty-three hundred and twenty, is known to exist within the boundaries of a placer claim, an application for a patent for such placer claim which does not include an application for the vein or lode claim shall be construed as a conclusive declaration that the claimant of the placer claim has no right of possession of the vein or lode claim; but where the existence of a vein or lode in a placer claim is not known, a patent for the placer claim shall convey all valuable mineral and other deposits within the boundaries thereof.

CALIFORNIA STATUTES REGARDING LOCATION OF MINING CLAIMS, MILL SITES AND ASSESSMENT WORK

An act to amend the Civil Code of California by adding a new title thereto, to be numbered title X, in part IV of division second, consisting of sections 1426, 1426*a*, 1426*b*, 1426*c*, 1426*d*, 1426*e*, 1426*f*, 1426*g*, 1426*h*, 1426*i*, 1426*j*, 1426*k*, 1426*l*, 1426*m*, 1426*n*, 1426*o*, 1426*p*, 1426*q*, 1426*r*, and 1426*s*, providing for the manner of locating lode and placer mining claims, tunnel rights, mill sites, and prescribing the character and amount of assessment work on mining claims, and providing for proofs of such work, and for the recordation of location notices, and proof of labor, and for the enforcement of contributions from delinquent co-owners of mining claims, and prescribing the duties of county recorders respecting the recording of location notices of, and proofs of labor on, mining claims, tunnel rights, and mill sites, and the fees to be charged therefor, and repealing acts in conflict herewith.

[Approved March 13, 1909.]

The people of the State of California, represented in senate and assembly, do enact as follows:

SECTION 1. The Civil Code of the State of California is hereby amended by adding a new title thereto, to be numbered title X, in part IV, of second division, consisting of sections 1426, 1426*a*, 1426*b*, 1426*c*, 1426*d*, 1426*e*, 1426*f*, 1426*g*, 1426*h*, 1426*i*, 1426*j*, 1426*k*, 1426*l*, 1426*m*, 1426*n*, 1426*o*, 1426*p*, 1426*q*, 1426*r*, and 1426*s*, to read as follows:

§ 1426. Any person, a citizen of the United States, or who has declared his intention to become such, who discovers a vein or lode of quartz, or other rock in place bearing gold, silver, cinnabar, lead, tin, copper, or other valuable deposit, may locate a claim upon such vein or lode, by defining the boundaries of the claim, in the manner hereinafter described, and by posting a notice of such location, at the point of discovery, which notice must contain:

First—The name of the lode or claim.

Second—The name of the locator or locators.

Third—the number of linear feet claimed in length along the course of the vein, each way from the point of discovery, with the width on each side of the center of the claim, and the general course of the vein or lode, as near as may be.

Fourth—The date of location.

Fifth—Such a description of the claim by reference to some natural object, or permanent monument, as will identify the claim located.

§ 1426*a*. The locator must define the boundaries of his claim so that they may be readily traced, and in no case shall the claim extend more than fifteen hundred feet along the course of the vein or lode, nor more than three hundred feet on either side thereof, measured from the center line of the vein at the surface.

§ 1426*b*. Within thirty days after the posting of his notice of location upon a lode mining claim, the locator shall record a true copy thereof in the office of the county recorder of the county in which such claim is situated, for which service the county recorder shall receive a fee of one dollar.

§ 1426*c*. The location of a placer claim shall be made in the following manner: By posting thereon, upon a tree, rock in place, stone, post or monument, a notice of location, containing the name of the claim, name of locator or locators, date of location, number of feet or acreage claimed, such a description of the claim by reference to some natural object or permanent monument as will identify the claim located, and by marking the boundaries so that they may be readily traced; *provided*, that where the United States survey has been extended over the land embraced in the location, the claim may be taken by legal subdivisions and no other reference than those of said survey shall be required and the boundaries of a claim so located and described need not be staked or monumented. The description by legal subdivisions shall be deemed the equivalent of marking.

§ 1426*d*. Within thirty days after the posting of the notice of location of a placer claim, the locator shall record a true copy thereof in the office of the county recorder of the county in which such claim is situated, for which service the recorder shall receive a fee of one dollar.

§ 1426*e*. The locator of a tunnel right or location, shall locate his tunnel right or location by posting a notice of location at the face or point of commencement of the tunnel, which must contain:

First—The name of the locator or locators.

Second—The date of the location.

Third—The proposed course or direction of the tunnel.

Fourth—A description of the tunnel, with reference to some natural object or permanent monument as shall identify the claim or tunnel right.

§ 1426*f*. The boundary lines of the tunnel shall be established by stakes or monuments placed along the lines at an interval of not more than six hundred feet from the face or point of commencement of the tunnel to the terminus of three thousand feet therefrom.

§ 1426*g*. Within thirty days after the posting the notice of location of the tunnel right or location, the locator shall record a true copy thereof, in the office of the county recorder of the county in which such claim is situated, for which service the recorder shall receive a fee of one dollar.

§ 1426*h*. If at any time the locator of any mining claim heretofore or hereafter located, or his assigns, shall apprehend that his original location notice was defective, erroneous, or that the requirements of the law had not been complied with before filing; or in case the original notice was made prior to the passage of this act, and he shall be desirous of securing the benefit of this act, such locator, or his assigns, may file an additional notice, subject to the provisions of this act; *provided*, that such amended location does not interfere with the existing rights of others at the time of posting and filing such amended location notice, and no such amended location notice or the record thereof, shall preclude the claimant, or claimants from proving any such title as he or they may have held under previous locations.

§ 1426*i*. Where a locator, or his assigns, has the boundaries and corners of his claim established by a United States deputy mineral survey, or a licensed surveyor of this state, and his claim connected with the corner of the public or minor surveys of an established initial point, and incorporates into the record of the claim, the field notes of such survey, and attaches to and files with such location notice a certificate of the surveyor, setting forth: *first*, that said survey was actually made by him, giving the date thereof; *second*, the name of the claim surveyed and the location thereof; *third*, that the description incorporated in the declaratory statement is sufficient to identify; such survey and certificate becomes a part of the record, and such record is prima facie evidence of the facts therein contained.

§ 1426*j*. The proprietor of a vein or lode claim or mine, or the owner of a quartz mill or reduction works, or any person qualified by the laws of the United States, may locate not more than five acres of non-mineral land as a mill site. Such location shall be made in the same manner as hereinbefore required for locating placer claims.

§ 1426*k*. The locator of a mill site claim or location shall, within thirty days from the date of his location, record a true copy of his location notice with the county recorder of the county in which such location is situated, for which service the recorder shall receive a fee of one dollar.

§ 1426*l*. The amount of work done or improvements made during each year to hold possession of a mining claim shall be that prescribed by the laws of the United States, to wit: One hundred dollars annually.

§ 1426*m*. Whenever [a] mine owner, company, or corporation shall have performed the labor and made the improvements required by law upon any mining claim, the person in whose behalf such labor was performed or improvements made, or some one in his behalf, shall within thirty days after the time limited for performing such labor or making such improvements make and have recorded by the county recorder, in books kept for that purpose, in the county in which such mining claim is situated, an affidavit setting forth the value of labor or improvements made, the name of the claim, and the name of the owner or claimant of said claim at whose expense the same was made or performed. Such affidavit, or a copy thereof, duly certified by the county recorder, shall be prima facie evidence of the performance of such labor or the making of such improvements, or both.

§ 1426*n*. For recording the affidavit herein required, the county recorder shall receive a fee of fifty cents.

§ 1426*o*. Whenever a co-owner or co-owners of a mining claim shall give to a delinquent co-owner or co-owners the notice in writing or notice by publication provided for in section 2324, Revised Statutes of the United States, an affidavit of the person giving such notice, stating the time, place, manner of service, and by whom and upon whom such service was made, shall be attached to a true copy of such

notice, and such notice and affidavit must be recorded in the office of the county recorder, in books kept for that purpose, in the county in which the claim is situated, within ninety days, after the giving of such notice; for the recording of which said recorder shall receive the same fees as are now allowed by law for recording deeds; or if such notice is given by publication in a newspaper, there shall be attached to a printed copy of such notice an affidavit of the printer or his foreman, or principal clerk of such paper, stating the date of the first, last and each insertion of such notice therein, and where the newspaper was published during that time, and the name of such newspaper. Such affidavit and notice shall be recorded as aforesaid, within one hundred and eighty days after the first publication thereof. The original of such notice and affidavit, or a duly certified copy of the record thereof, shall be prima facie evidence that the delinquent mentioned in section 2324 has failed or refused to contribute his proportion of the expenditure required by that section, and of the service of publication of said notice; *provided*, the writing or affidavit hereinafter provided for is not of record. If such delinquent shall, within the ninety days required by section 2324, aforesaid, contributed to his co-owner or co-owners, his proportion of such expenditures, and also all costs of service of the notice reuired by this section, whether incurred for publication charges, or otherwise, such co-owner or co-owners shall sign and deliver to the delinquent or delinquents a writing stating that the delinquent or delinquents by name has within the time required by section 2324 aforesaid, contributed his share for the year_____, upon the_____ mine, and further stating therein the district, county and state wherein the same is situated, and the book and page where the location notice is recorded, if said mine was located under the provisions of this act; such writing shall be recorded in the office of the county recorder of said county, for which he shall receive the same fees as are now allowed by law for recording deeds. If such co-owner or co-owners shall fail to sign and deliver such writing to the delinquent or delinquents within twenty days after such contribution, the co-owner or co-owners so failing as aforesaid shall be liable to the penalty of one hundred dollars, to be recovered by any person for the use of the delinquent or delinquents in any court of competent jurisdiction. If such co-owner or co-owners fail to deliver such writing within said twenty days, the delinquent, with two disinterested persons having personal knowledge of such contribution, may make affidavit setting forth in what manner, the amount of, to whom, and upon what mine, such contribution was made. Such affidavit, or a record thereof, in the office of the county recorder of the county in which such mine is situated, shall be prima facie evidence of such contribution.

§ 1426*p*. The record of any location of a mining claim, mill site or tunnel right, in the office of the county recorder, as herein provided shall be received in evidence, and have the same force and effect in the courts of the state as the original notice.

§ 1426*q*. Copies of the records of all instruments required to be recorded by the provisions of this act, duly certified by the recorder, in whose custody such records are, may be read in evidence, under the same circumstances and rules as are now, or may be hereafter provided by law, for using copies of instruments relating to real estate, duly executed or acknowledged or proved and recorded.

§ 1426*r*. The provisions of this act shall not in any manner be construed as affecting or abolishing any mining district or the rules and regulations thereof within the State of California.

§ 1426*s*. The failure or neglect of any locator of a mining claim to perform development work of the character, in the manner and within the time required by the laws of the United States, shall disqualify such locators from relocating the ground embraced in the original location or mining claim or any part thereof under the mining laws, within three years after the date of his original location and any attempted relocation thereof by any of the original locators shall render such location void.

SEC. 2. All acts and parts of acts in conflict with this act, are hereby repealed.

SEC. 3. This act shall take effect and be in force on and after July 1, 1909.

FORMS FOR LOCATION NOTICES

The following forms for mineral location notices have been found to fill the requirements of the statutes, in California:

NOTICE OF QUARTZ LODE LOCATION

Notice is hereby given, That I, _____, have discovered a vein of rock in place, carrying valuable deposits, upon which I have erected a discovery monument and posted this notice, as hereinafter set forth; that in accordance with the provision of chapter VI, title XXXII of the Revised Statutes of the United States and the laws of the State of California, I hereby claim fifteen hundred linear feet of said vein, measured thereon as hereinafter set forth. Said discovery was made on the_____day of_____, 19____. Immediately upon making the same, and on the_____day of_____, 19____, I erected at the point of discovery, a substantial monument, consisting of a mound of rocks and_____and posted thereon this notice.

The *general course of said vein is_____and_____. I claim in length thereon_____feet_____and_____feet_____from said discovery monument. I also claim three hundred feet on each side of the center of the vein. This vein or claim shall be known as and called the_____. It is situated in_____Mining District, and in †Sec._____, Tp._____, R._____, B. and M., in_____County, California, and the discovery monument_____being placed about §

_____

from_____

That the following is a description of said location as marked upon the ground: ‡ commencing at the_____of said claim, a_____

_____from which initial point the discovery monument is distant about_____feet in a_____direction; _____ thence ||_____

_____

Dated, this_____day of_____, 19____.

_____

_____

Locator.

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* Make this description in accordance with the facts, as "The general course of said vein is north and south. I claim in length thereof (for example) 500 feet north and 1000 feet south from said discovery monument."

† If the claim is upon surveyed land, give the section, township and range, if possible. This is not required by law, but makes a much better description.

§ Here refer to some natural object or permanent monument so as to identify the locality of the claim, in compliance with section 2324, Revised Statutes U. S. A road, house, tree, known mountain or peak, government corner, mill, or known mining claim, are such objects or monuments. As, "About one mile directly east from John Doe's quartz mill and 400 rods west from the Last Hope mine," etc.

‡ Here state (for example): "Commencing at the NE. corner of said claim, a mound of rocks 4 ft. high," or at any other corner or point in the boundary; give the distance and direction from this initial monument to the discovery monument, and then locate the discovery with reference to some natural object or permanent monument.

|| Here follows a description of the claim from the initial monument. For instance: "Thence 600 ft. northwesterly to the NW. corner of said claim, at which point is a mound of rocks 2½ ft. high, marked so-and-so (if marked); thence 1500 ft. southwesterly to the SW. corner of said claim, being a mound of rocks," etc.; so going around the claim to the point of beginning.

NOTICE OF LOCATION OF PLACER CLAIM

Notice is hereby given, That_____ citizen____of the United States, h____this_____day of _____, 19____, discovered a valuable placer deposit within the limits of this claim; that by virtue of said discovery, _____ _____ha____located, and hereby locate and claim the following described land, situate in_____Mining District, _____County, California, to wit: *_____of section_____ township_____, range_____, B. and M., containing_____ acres.† Said claim is hereby named_____Placer Claim. Said claim is marked upon the ground as follows: ‡_____

This notice is posted on a mound of rocks at the point of discovery, situated §

_____

Dated and posted on the ground, this_____day of_____, 19____.

_____

Locator.

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* The statute provides that the locator must give "a description of the claim by reference to legal subdivisions of sections, if the location is made in conformity with the public surveys; otherwise a description with reference to some natural object or permanent monument as will identify the claim."

† When not described by legal subdivisions, the description should conform to that contained in the final certificate of location of a lode claim.

‡ The statute provides that, whether described by legal subdivisions or not, the location shall be marked by the locator on the ground, and as the affidavit to be filed later is not required to contain a description of the claim, we think this notice should state how the location is marked; as, for instance, "At the NE corner of said tract a mound of rocks 3 ft. high, marked so-and-so (if marked), and at the NW corner a stake in a mound of rocks, marked," etc., and so on for each monument enclosing the claim.

§ Here state where the discovery is located, as, for instance, "20 feet SW of the NE. corner monument."

NOTE: A duplicate of either of these notices must be filed for record with the county recorder within 30 days from the discovery; and the locator is allowed 30 days to mark his location on the ground.

The foregoing form of placer notice may be used for location of all deposits which are classed under placer laws and not excepted by The Leasing Act of February 25, 1920 (see Oil and Gas Rights, pp. 212–215, 218–285, *ante*.)

ADMINISTRATIVE DIVISION

WALTER W. BRADLEY, Deputy State Mineralogist

Personnel

Mr. Lloyd L. Root has resigned as State Mineralogist, effective August first, and will engage in private practice as consulting mining engineer. Mr. Root assumed the duties of the office in February, 1923, under appointment by Governor Friend W. Richardson.

Mr. Walter W. Bradley, for the past five and a half years deputy state mineralogist, has been appointed State Mineralogist and Chief of the Division of Mines and Mining, succeeding Lloyd L. Root, resigned. Mr. Bradley joined the staff of the State Mining Bureau on January 8, 1912, as Librarian, and has advanced through the several positions of field engineer, statistician and curator, and deputy state mineralogist. He is a graduate of the University of California, College of Mining, 1901, receiving also the degree of Mining Engineer (of doctorate rank at California) in 1918. In announcing this selection for state mineralogist Mr. Fred G. Stevenot, director of the State Department of Natural Resources, states that the present administration is adopting a policy of promotion from within rather than political appointment from without. He adds: "I am fully convinced that every encouragement should be held out to subordinates of proven ability to expect that they be granted the privilege whenever possible of being advanced to the highest position within the various divisions."

Mr. Charles V. Averill is district mining engineer in charge of the branch office at Redding, which was reestablished May 8, 1928. Mr. Averill is a graduate of the University of California, with subsequent engineering experience in Nevada and California.

Redding Branch Office

The territory assigned to the Sacramento district being too extensive to be covered effectively by a single engineer, it was deemed advisable to divide the northern area of the state and place an engineer in Redding, where he will be in closer touch with mineral developments and the operators in the northern counties. Through the courtesy and cooperation of the Redding Chamber of Commerce, office space has been provided in their quarters.

The counties assigned to the Redding district are Del Norte, Humboldt, Lassen, Modoc, Plumas, Shasta, Siskiyou, Tehama and Trinity.

New Publications

During the quarterly period covered by this issue, the following publications of the Division of Mines and Mining have been made available for distribution:

Mining in California (quarterly), January, 1928 and April, 1928, being Chapters 1 and 2, respectively, of State Mineralogist's Report XXIV. Price 25 cents, each. The January issue contains a report on the Mineral Resources of Tuolumne County; and the April, a report on the Mineral Resources of Mariposa County.

Summary of Operations, California Oil Fields, Vol. 13, Nos. 6 and 7, December, 1927, and January, 1928, respectively. These contain articles on: "Production Records and Methods of Measuring Fluids," and "Report on the Kern Front Area of the Kern River Oil Field."

Commercial Mineral Notes, Nos. 61, 62, 63, 64, April, May, June, July, 1928, respectively. These "notes" contain the lists of "mineral deposits wanted" and "minerals for sale" issued in the form of a mimeographed sheet monthly. It is mailed free to those on the mailing list for MINING IN CALIFORNIA.

Mails and Files

The Division of Mines maintains, in addition to its correspondence files and the library, a mine file which includes original reports on the various mines and mineral properties of all kinds in California.

During each quarterly period there are several thousand letters received and answered at the San Francisco office alone, covering almost every phase of prospecting, mining, and developing mineral deposits, reduction problems, marketing of refined products, and mining law. In addition to this, hundreds of oral questions are answered daily, both at the main office and the district offices, for the many inquirers who come in for personal interviews and to consult the files and library.



DIVISION OF MINERALS AND STATISTICS

Statistics, Museum, Laboratory

HENRY H. SYMONS, Statistician and Curator

STATISTICS

Data on the 1927 production of several California minerals were given in the April issue of MINING IN CALIFORNIA, and some additional ones are presented herein. Copy of the complete annual report for the year is now being prepared and will shortly go to the printer as Bulletin No. 101 of the Division of Mines and Mining.

COPPER

Copper is second only to gold among the metals mined in California. The output for 1927 amounted to a total of 27,350,316 pounds of recoverable metal valued at $3,582,888, a decrease from the 1926 figures of 33,521,544 pounds and $4,693,014. The average price of copper for 1927 was 13.1 cents per pound against 14.0 cents in 1926.

As for several years past, Plumas County ranks first for 1927, with an output of 21,055,425 pounds; Shasta second with 4,524,906 pounds; and Trinity third with 770,882 pounds.

Distribution of the 1927 copper output by counties was as follows:

County	*Pounds*	*Value*
Calaveras	750,909	$98,367
Inyo	30,010	3,931
Plumas	21,055,425	2,758,261
Riverside	19,201	2,515
San Bernardino	197,132	25,824
Shasta	4,524,906	592,763
Trinity	770,882	100,986
Amador, Butte, El Dorado, Imperial, Kern, Los Angeles, Mono, Napa, Nevada, San Luis Obispo, Sierra*	1,851	241
Totals	27,350,316	$3,582,888

* Combined to conceal output of a single operator in each.

GOLD

The production of gold in California in 1927 totaled 564,585.50 fine ounces, worth $11,671,018, being a decrease of 12,212.90 fine ounces from the 1926 yield. The 'deep' or lode mines output accounted for $5,833,705, and the placers (mainly the dredges) produced $5,837,313. As the Division of Mines and Mining has never independently gathered the statistics of gold and silver production, these figures, as in former years, are published by cooperation with and through the courtesy of Mr. J. M. Hill of the Division of Minerals and Statistics, U. S. Bureau of Mines.

The largest gold production for 1927, is reported from Yuba County with an output of 167,774.20 fine ounces ($3,468,201); Nevada County with 102,903.07 fine ounces ($2,127,195), second; Amador County with 93,011.27 fine ounces ($1,922,714), third; Sacramento County with 58,595.57 fine ounces, fourth; followed by Sierra and Trinity counties in fifth and sixth places, respectively. It will be noted, as in 1926, Yuba County was the largest gold producer with Nevada, Amador, and Sacramento following, respectively, in the same order. The Yuba and Sacramento production came almost entirely from dredges, while that from Nevada and Amador came mainly as lode gold.

GOLD PRODUCTION BY COUNTIES FOR 1927

County	Value	County	Value
Alpine	$146	Monterey	$500
Amador	1,922,714	Napa	7,235
Butte	143,494	Nevada	2,127,195
Calaveras	219,217	Placer	97,494
Del Norte	384	Plumas	321,016
El Dorado	82,254	Riverside	1,492
Fresno	17,406	Sacramento	1,211,278
Humboldt	1,729	San Bernardino	82,225
Imperial	257	San Diego	11,490
Inyo	10,109	Shasta	191,900
Kern	171,100	Sierra	678,873
Lassen	531	Siskiyou	138,822
Los Angeles	2,345	Stanislaus	120,238
Madera	4,181	Trinity	409,492
Mariposa	183,805	Tuolumne	40,209
Mono	3,686	Yuba	3,468,201
		Total	$11,671,018

LEAD

The production of lead in California in 1927 was 2,748,440 pounds of recovered metal valued at $173,235 as against the production of 1926 of 8,067,873 pounds valued at $645,429. The average price of lead in 1927 was 6.3 cents a pound against 8.0 cents in 1926 and 8.7 cents in 1925.

As in the past the principal output of lead was from the lead-silver ores of Inyo County.

Lead production by counties for 1927:

County	Pounds	Value
Amador	2,491	$157
Calaveras	4,606	290
Inyo	2,173,032	136,901
Los Angeles	312,645	19,697
Mono	4,830	304
Riverside	121,667	7,665
San Bernardino	125,692	7,919
Shasta	1,780	112
Butte, Nevada, Plumas*	1,691	106
Totals	2,748,440	$173,151

* Combined to conceal output of a single operator in each.

PETROLEUM

The crude petroleum produced in California for 1927, amounted to a total of 231,195,773 barrels of clean oil, valued at $260,735,491 at the well. This total of quantity is compiled from the monthly production reports filed by the operators with the State Oil and Gas Supervisor, to which have been added figures for the output of a number of small operators in the old Los Angeles City field not under the jurisdiction of the Supervisor.

The question of the value of the crude oil yield at the well is a difficult one to settle with exactitude, principally because a large part of the output is not sold until after refined. The large refiners are also large producers of crude oil which they send direct from the well to the refinery, hence much of the crude oil is not sold as such. The value used in the statistical reports of the Division of Mines and Mining since 1914 has been derived from the average of actual sales of crude oil of all grades in each field of the state, and the averages applied to the total yield of the respective fields. This we feel is a safer measure of commercial values than market quotations, because quotations do not always mean sales. This is particularly true on a rising or a falling market.

The following table gives the production and value by counties for 1927, compared with the 1926 figures:

County	1926 Barrels	1926 Value	1927 Barrels	1927 Value
Fresno	7,340,102	$5,982,183	7,202,285	$5,977,176
Kern	54,549,646	78,987,887	51,570,412	58,738,699
Los Angeles	105,826,337	174,084,324	103,625,615	114,583,011
Orange	37,989,349	59,225,395	46,593,842	56,238,767
San Luis Obispo	27,982	22,162	16,709	12,531
Santa Barbara	1,925,204	1,526,587	2,173,887	1,630,415
Santa Clara	[a]		11,994	14,212
Ventura	16,994,275	25,695,344	19,996,841	23,536,282
Kings, San Bernardino, San Mateo, Santa Clara, Sonoma	[a]20,386	22,795		
Kings, San Bernardino, San Mateo, Sonoma			[a]4,188	4,398
Totals	224,673,281	$345,546,677	231,195,773	$260,735,491

[a] Combined to conceal output of a single operator in each.

OIL IN 'STORAGE'

Field, refinery, pipe-line and tank-farm stock of crude and refinery products in the Pacific Coast territory totals 137,395,067 barrels[1], December 31, 1927, compared with 145,612,176 barrels on December 31, 1926. The total decrease in stock for the year was 8,217,109.

Stock	Dec. 31, 1927	Dec. 31, 1926
Heavy crude, heavier than 20° A. P. I., including all grades of fuel	93,013,061	88,707,499
Refinable crude 20° A. P. I. and lighter	20,268,569	30,835,057
Gasoline	12,725,841	11,673,563
Naptha distillates	1,901,279	3,832,042
All other stocks	9,486,317	10,564,015
Totals of all stock	137,395,067	145,612,176

[1] Standard Oil Bulletin, February, 1928, p. 11.

PROVED OIL LAND

The total proved oil land of the state is 125,131 acres, an increase during 1927 of 3,696 acres. Of this amount 23,927 acres, being owned by Federal, State and City governments, or for other reasons, is not assessable for the support of the Department of Petroleum and Gas of the Division of Mines and Mining. The acreage in 1927 was distributed by counties as follows:

County	Land	Number of wells
Fresno	14,665	985
Kern	80,075	5,574
Los Angeles	10,794	3,311
Orange	6,797	1,422
San Luis Obispo	308	18
Santa Barbara	7,474	329
Santa Clara	80	4
Ventura	4,938	699
Kings, San Bernardino and Sonoma		3
Totals	125,131	12,345

PLATINUM

In California the platinum group metals are obtained as a by-product from placer operations for gold. The major portion of it comes from the dredges working in Butte, Sacramento, Stanislaus and Shasta counties, with a small amount coming from the hydraulic and

surface-sluicing mines of Del Norte, Humboldt, Siskiyou, and Trinity counties.

The production of platinum metals in California for 1927 totaled 183 ounces, crude, containing 139 fine ounces, valued at $10,757, compared with the 1926 figures of 322 fine ounces and $32,005. Of this amount 102 fine ounces or 73% came from the gold dredges. In addition to the above metal there was some platinum mined but not sold in 1927 in Butte, Trinity and Yuba counties.

Of the above 183 fine ounces, at least 37 fine ounces were iridium, osmium, palladium and ruthenium. Most of the platinum refiners pay for the osmiridium on the basis of its iridium content. Crude 'platinum' is really a mixture of the metals of that group, and carries varying percentages of platinum, iridium, osmiridium or iridosmine, with occasionally some ruthenium and palladium. In addition to the above-noted production, there is usually some platinum recovered as a by-product in the gold refinery of the mint, but which can not be assigned to the territory of its origin for lack of knowing to which lots of gold it belongs. Some platinum and palladium are also recovered in the electrolytic refining of blister copper.

For 1926, the distribution by counties of California's platinum yield was as follows:

County	*Fine ounces*	*Value*
Butte [a]	7	$499
Shasta [a]	26	2,505
Siskiyou	9	690
Del Norte, Humboldt, Sacramento[b] Stanislaus[a] and Trinity*	97	7,057
Totals	139	$10,751

* Combined to conceal output of a single operator in each.
[a] Includes iridium and osmium.
[b] Includes iridium, osmium, palladium and ruthenium.

QUICKSILVER

The production of quicksilver for 1927 in California was 6488 flasks (of 75 pounds, avoirdupois) valued at $714,418. This was an increase in both quantity and value over the 1926 figure of 5892 flasks, valued at $516,382. This production came from Lake, Monterey, Napa, Orange, San Benito, San Luis Obispo and Sonoma counties, the largest production coming from San Benito, with Napa in second place.

The average price for quicksilver in 1927 was $117.25 for 76 pounds flask at San Francisco or $115.71 for 75 pounds against $87.64 per 75-pound flask in 1926.

SILVER

Except for the early-day production from the silver mines of the Calico district and the more recent production from those of the Randsburg area, both of which are in San Bernardino County, the recovery of silver in California has been largely as a by-product from its association with copper, lead, zinc, and gold ores.

The 1927 silver production of California totaled 1,620,242 fine ounces valued at $918,677, compared with 2,022,460 ounces valued at $1,262,015 in 1926. Of the 1927 yield, 20,903 ounces valued at $11,852 came from placers. The average price of domestic silver during 1927 was 56.7 cents per ounce in New York against 62.4 cents in 1926.

The distribution of the 1927 silver yield, by counties, was as follows:

SILVER PRODUCTION BY COUNTIES

County	*Fine ounces*	*Value*
Alpine	105	$60
Amador	19,963	11,319
Butte	655	371
Calaveras	7,023	3,982
Del Norte	2	1
El Dorado	675	383
Fresno	136	77
Humboldt	25	14
Imperial	5	3
Inyo	83,570	47,384
Kern	15,753	8,932
Lassen	16	9
Los Angeles	26,135	14,819
Madera	67	38
Mariposa	2,427	1,376
Mono	38,487	21,822
Monterey	4	2
Napa	99,532	56,435
Nevada	48,644	27,581
Placer	776	440
Plumas	315,887	179,108
Riverside	3,385	1,919
Sacramento	2,596	1,472
San Bernardino	788,580	447,125
San Diego	162	92
Shasta	123,917	70,261
Sierra	5,909	3,350
Siskiyou	1,033	586
Stanislaus	608	345
Trinity	21,739	12,326
Tuolumne	533	302
Yuba	11,893	6,743
Totals	1,620,242	$918,677

ZINC

The recoverable zinc mined in California in 1927 amounted to 8,625,004 pounds valued at $552,000, compared with 20,447,559 pounds and $1,533,568 in 1926. The production came from Shasta, Los Angeles (Santa Catalina Island), and Riverside counties, and was shipped in the form of concentrates and sinter to Belgium, though a small amount is used in the manufacture of oxide.

The average price per pound quoted for the metal in 1927, was 6.4 cents as against 7.5 cents in 1926.

MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections in North America; and contains not only specimens of most of the known minerals found in California, but much valuable and interesting material from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well as by those who utilize the facilities of the collection.

The exhibit is daily visited by engineers, students, business men, and prospectors as well as tourists and mere sightseers. Besides its practical use in the economic development of California's mineral resources, the collection is a most valuable educational asset to the state and to San Francisco.

LABORATORY

FRANK SANBORN, Mineral Technologist

The demand for caesium and beryllium appears to be greater than the present supply. The main source of caesium is the mineral pollucite, while beryl is the chief ore of beryllium.

Pollucite has been found at Mesa Grande, San Diego County. It is quite possible that this mineral occurs in other sections of the state, but has not been identified on account of its close resemblance to quartz. Pollucite resembles quartz, but the fact that it is decomposed by hydrochloric acid aids as a field test to distinguish it from quartz.

Caesium is a silver-white, soft, ductile metal. It oxidizes in the air with the production of light and heat, and decomposes violently in water at ordinary temperatures. Compounds of caesium have been until recently used chiefly in chemistry, but its use has now been extended to radio, and therefore the increased demand.

Beryl has been found in a number of different localities in California, but the greatest amount so far known occurs in feldspathic pegmatite veins in Riverside and San Diego counties. It has also been reported from San Bernardino and other counties. Pegmatites of these districts may yield pollucite, and prospectors should look for this mineral.

Approximately thirty samples per day are received and determined at this laboratory, proving that the public is showing a live and increasing desire to find commercial deposits of nonmetals as well as metallic deposits.

LIBRARY

E. A. Lowe, Librarian.

In addition to the numerous standard works, authoritative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the Division of Mines and Mining contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, Mining in California contains under this heading a list of all books and official reports and bulletins received, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the state are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

OFFICIAL PUBLICATIONS RECEIVED

Governmental

U. S. Geological Survey:

Professional Papers:

150–F—Notes on Pleistocene Faunas from Maryland and Virginia and Pliocene and Pleistocene Faunas from North Carolina. By Wendell C. Mansfield.

150–E—The Pocono Fauna of the Board Top Coal Field, Pennsylvania. By George H. Girty.

150–D—Sedimentary Rocks of the San Rafael Swell and Some Adjacent Areas in Eastern Utah. By James Gilluly and John B. Reeside, Jr.

142–E—The Molluscan Fauna of the Alum Bluff Group of Florida. By Julia Gardner.

Bulletins:

806 —Bibliography of North American Geology for 1925 and 1926. By John M. Nickles.

793 —Economic Geology of the Castlegate, Wellington and Sunnyside Quadrangles, Carbon County, Utah. By Frank R. Clark.

795 —Contributions to Economic Geology, Part I—Metals and Nonmetals except Fuels. By G. F. Loughlin and G. R. Mansfield.

796 —Contributions to Economic Geology, Part II—Mineral Fuels.

796–B—Geology and Oil Prospects of Northeastern Colorado. By Kirtley F. Mather, James Gilluly and Ralph G. Lusk.

788–F—Topographic Instructions of the United States Geological Survey. By T. P. Pendleton.

788–E—Topographic Instructions of the United States Geological Survey. By W. M. Beaman.

Water Supply Papers:

596-G—Chemical Character of Waters of Florida. By W. D. Collins and C. S. Howard.
577 —Plants as Indicators of Ground Water. By Oscar Edward Meinzer.
579 —Power Capacity and Production in the United States. By C. R. Daugherty, A. H. Horton, and R. W. Davenport.
573 —Surface Water Supply of the United States. 1923, Part XII—North Pacific Slope Drainage Basins. B. Snake River Basin.
587 —Surface Water Supply of the United States, 1924, Part VII—Lower Mississippi River Basin.
585 —Surface Water Supply of the United States, 1924, Part V— Hudson Bay and Upper Mississippi River Basins.
582 —South Atlantic Slope and Eastern Gulf of Mexico Basins.
576 —The Ground-Water Resources of Mississippi.
571 —Pacific Slope Basins in California.

Hawaiian Volcano Observatory: Monthly Bulletin of the, Vol. XV, Nos. 2, 3, 4, 5, 6, 7, 8, 9.

U. S. Bureau of Mines:

Technical Papers:

424 —Thermodynamic Properties of Oxygen and Nitrogen. By Russell W. Millar and John D. Sullivan.
411 —Analyses of Oklahoma Coals. By C. L. Cooper.
416 —Analyses of Arkansas Coals. By George C. Branner.
421 —State Laws Relating to Coal-Mine Timbering. By J. W. Paul and J. N. Geyer.
418 —Electric-Furnace Cast Iron. By C. W. Williams and C. E. Sims.
429 —Permissible Single-Shot Blasting Units. By L. C. Ilsley and A. B. Hooker.
414 —Methods of Dealing with Paraffin Troubles Encountered in Producing Crude Oil. By C. E. Reistle, Jr.
433 —Experiments in Underground Communication Through Earth Strata. By L. C. Ilsley, H. B. Freeman and D. H. Zellers.
427 —Propagation of Flame in Mixtures of Natural Gas and Air. By H. F. Coward and H. P. Greenwald.

Bulletins:

279 —Limits of Inflammability of Gases and Vapors. By H. F. Coward and G. W. Jones.
291 —Tabulated Analyses of Representative Crude Petroleums of the United States. By N. A. C. Smith and E. C. Lane.

Miners' Circulars:

30 —Use of the Miners' Self-Rescuer. By S. H. Katz and J. J. Forbes.
31 —Questions and Answers on Timbering Bituminous Coal Mines. By J. W. Paul.

Mineral Resources of the United States:

Cement in 1926.
Sand and Gravel in 1926.
Lead in 1926.
Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1926.
Secondary Metals in 1926.
Sulphur and Pyrites in 1926.
Gold, Silver, Copper, Lead and Zinc in Montana in 1926.
Gold, Silver, Copper, Lead and Zinc in Idaho and Washington in 1926.
Petroleum in 1926.
Part I, Metals. Part II, Nonmetals.
Statistical Summary of the California Petroleum Industry, 1927.
List and Index of Bureau of Mines Reports of Investigations and Information Circulars.

Reports of Investigations:

2859—Portable Electric Cap Lamps in Alabama. By Frank E. Cash.
(Reviews progress made in Alabama in the introduction of permissible portable electric cap lamps, recommended by Bureau of Mines as safest type for use in mines. Gives list of lamps used, with descriptions and suggestions regarding use and maintenance.)

2860—Flotation of Low-Grade Phosphate Ores. By H. M. Lawrence and F. D. DeVaney.

(Present results so far attained in use of flotation process to obtain higher recoveries of phosphate rock than are now being achieved in Florida district.)

2861—Seventeenth Semi-Annual Motor Gasoline Survey. By E. C. Lane, Peter Grandone and D. B. Taliaferro, Jr.

(Summarizes characteristics of representative motor gasoline samples collected in eleven cities, thus affording information as to nature of motor gasolines being used throughout the United States.)

2862—A Rapid Corrosion Test for Gasoline. By H. P. Rue.

(Gives details of a mercury corrosion test which offers possibilities in the proper control of gasoline treating plants.)

2863—Explosibility of Sulphide Dusts in Metal Mines. By E. D. Gardner and Edmund Stein.

(Gives results of a study of a high sulphur ore from a metal mine in which a serious accident had occurred due to an explosion and burning of sulphide dust. Points out that massive sulphides occurring in metal mines are inflammable and furnish the fuel for many mine fires.)

2864—Official Changes in the Active List of Permissible Explosives for March, 1928.

(Supplements latest complete active list of permissible explosives, published in July, 1927, as Serial 2818.)

2865—Rock-Strata Gases in the Cripple Creek District and Their Effect on Mining. By E. H. Denny, K. L. Marshall, and A. C. Fieldner.

(Gives results of study of gases which have caused numerous fatalities in this district, and recommends remedial measures.)

2866—A Comparison of the Results Obtained With the Oxygen-Bomb and Carius Methods in Determining Sulphur in the Heavier Petroleum Oils. By John M. Devine and F. W. Lane.

(Summarizes tests which indicate that the simpler oxygen-bomb method of determining sulphur in petroleum is entirely adequate for routine laboratory work and also for research purposes unless results of the highest accuracy are essential.)

2867—Titanium in Bauxite Ores and Sludges. By Will H. Coghill.

(Contains data obtained in study of waste sludge containing over 75,000 pounds of titanium dioxide discharged daily at a bauxite lixiviation plant, and discusses titanium content of various bauxite ores.)

2868—Insulated Mine-Car Couplings. By F. E. Cash and C. W. Owings.

(Describes four types of insulated mine car couplings devised for the prevention of accidents in electric haulage of explosives in mines due to electric current passing from the locomotive through the couplings to the cars.)

2869—The Production of High-Alumina Slags in the Blast Furnace for the Manufacture of Alumina Cement. By T. L. Joseph.

(Discusses economic possibilities of production of high-alumina slags for manufacture of alumina cement through operation of blast furnace on a charge of bauxite, limestone and iron ore.)

2870—The Occurrence of Jarosite Minerals in Oxidized Lead Ores as a Factor in Metal Losses. By R. E. Head and Virgil Miller.

(Points out that the occurrence of jarosite minerals in oxidized lead ores, often overlooked by metallurgists, is responsible for large losses in treatment of these ores, and suggests modified methods of treatment.)

2871—Flue Dusts from Copper Smelters of the Southwest: Composition and Methods of Treatment. By William A. Sloan.

(Discusses proposed hydrometallurgical processes for recovery of valuable metallic flue dusts in substitution for present practice of returning dusts to smelting furnaces for retreatment.)

2872—The Use of Brattice Cloth in Coal Mines. By George S. Rice and C. W. Owings.

(Contains information in regard to nature, cost, use and deterioration of brattice cloth, used in large quantities in ventilation of coal mines.)

2873—Notes on Extraction and Recovery of Radium, Vanadium, and Uranium from Carnotite. By H. A. Doerner.

(Gives details of a modified nitric acid method for recovery of radium now discarded in carnotite tailings from which the vanadium has been extracted.)

2874—Milling Baboquivari Ores. By Edmund S. Leaver and Jesse A. Woolf.

(Outlines suggested method for cyanide extraction of silver and gold content of metallurgically difficult ores in Baboquivari, Arizona, mining district.)

2875—Accident—Severity Rates for Certain Mines and Quarries in 1927. By W. W. Adams.

(Gives detailed results of a nation-wide safety contest in which more than 250 mines and quarries participated.

2876—Use of the Acetylene Tetrachloride Method of Porosity Determination in Petroleum Engineering Field Studies. By Chase E. Sutton.

(Gives results of tests made in Texhoma-Gose oil pool, Texas, of a method which has various advantages for determining the average porosity of oil sands, essential to an engineering study of underground conditions.)

2877—Flotation of Fluorspar Ores for Acid Spar. By Will H. Coghill and O. W. Greeman.

(Outlines suggested method for flotation of fluorspar ores as a means of making more acid spar available, thus giving a better balance to markets in which gravel spar greatly predominates.)

2878—Copper Milling Research in Michigan. By A. W. Fahrenwald.

(Contains details of flotation tests of Michigan native copper ores, which promise increased recovery of copper with a substantial reduction in production costs.)

Information Circulars:

6062—Natural-Gasoline Plants in the United States. By G. R. Hopkins and E. M. Seeley.

(Gives results of statistical survey of natural-gasoline plants operating as of January 1, 1928. Contains list of such plants, arranged by states, with data as to type and daily capacity.)

6063—Mine Rescue Organization in the Coeur d'Alene Mining District, Idaho. By W. J. Fene and Hugh McDermott.

(Describes housing facilities, equipment and rescue training program of one of the most complete mine-rescue organizations in the United States.)

6064—Accident-Prevention Work of the Midwest Refining Company. By E. H. Denny.

(Outlines accident prevention methods employed by a large oil refining company which has been notably successful in its safety endeavors.)

6065—Petroleum Refineries in the United States, January 1, 1928. By G. R. Hopkins.

(Gives results of statistical survey of petroleum refineries operating in the United States as of January 1, 1928. Contains complete list of refineries, with data as to daily capacity, type of plant, and railroad connections.)

6066—Form of Report for Underground Accidents. By E. D. Gardner and D. J. Parker.

(Presents suggested detailed outline for accident report to general manager of mine, which it is thought should be of value in the study of mine accidents and their prevention.)

6067—Touch Paper. By D. J. Parker.

(Describes method of blasting in coal mines by use of the so-called "touch paper," points out the hazards of the practice, and recommends substitution of other methods.)

6068—Development and Safety of the Storage-Battery Locomotive. By L. C. Ilsley.

(Reviews development of the storage-battery locomotive used in coal-mining operations, and stresses advisability of using in gassy mines only such locomotives as have been approved by Bureau of Mines as "permissible."

6069—The Mining of Gilsonite in Utah. By W. J. Fene.

(Describes methods used in mining of this asphaltic material, and contains historical account of development of this industry.)

6070—Hazards in Connection with Concentrated Coal Mining. By D. Harrington.

(Summarizes hazards involved in mining of coal by modern mechanical mining systems and gives recommendations as to safe operation in such concentrated systems of mining.)

6071—Exports of Mineral Oils from Gulf Coast Ports in 1927. By Arthur H. Redfield.

(Statistical summary of exports of gasoline, kerosene, fuel oil and gas oil, with tabulation showing to which countries these materials were shipped.)

6072—Russian Papers on Measurements of Terrestrial Radioactivity. By L. N. Bogoiavlensky, A. A. Lomakin, and A. Cherepenikov, with a supplementary chapter on Radioactive Substances and Methods for Locating Them. By F. W. Lee.

(Translations of papers by various Russian authors dealing with the use of radioactive indications for determining the location of underground mineral deposits. Includes brief bibliography on radioactivity and its application to geophysical prospecting for minerals.)

6073—Fires and Fire Prevention in Lake Superior Mines. By F. C. Gregory.

(A review of the mine fire record of the Lake Superior metal mining district, with information as to costs of fires, fire prevention results and fire fighting methods.)

U. S. National Museum:

Zeolites from Ritter Hot Springs, Grant County, Oregon. By D. F. Hewett, Earl B. Shannon and Forest A. Gonyer.

Concerning the Origin of the Metal in Meteorites. By Geo. P. Merrill.

Colorado Bureau of Mines: Annual Report for the Year 1927.

Connecticut State Geological and Natural History Survey: Bulletin No. 42—The Algae of Connecticut. By Clarence John Hylander, Ph. D.

Idaho Bureau of Mines and Geology:

Pamphlet No. 26—Geology and Ore Deposits of Rocky Bar Quadrangle. By S. M. Ballard.

Pamphlet No. 27—Geology and Ore Deposits of the Birch Creek District, Idaho. By P. J. Shenon.

Idaho Inspector of Mines:

Twenty-ninth Annual Report on the Mining Industry of Idaho for the Year 1927.

Illinois Geological Survey:

Bulletin 53—Geology and Economic Resources of the St. Peter Sandstone of Illinois. By J. E. Lamar.

Bulletin 54—Oil and Gas East-Central Illinois. By L. A. Mylius.

Report of Investigations No. 15—Preliminary Report on the Fullers Earth Deposits of Pulaski County. By J. E. Lamar.

Report of Investigations No. 16—The Oil and Gas Resources of the Ava-Campbell Hill Area. By Towner B. Root.

Iowa Geological Survey:

Annual Report of, 1925–1926, Vol. XXXII.

Kentucky Geological Survey:

Series VI—Ancient Life in Kentucky. By William Snyder Webb and William Delbery Funkhouser.

Early Carbonic Deformation in Western Kentucky. By Willard R. Jillson.

Mississippi Geological Survey:

Bulletin 21—Recent Oil and Gas Prospecting in Mississippi With a Brief Study of Subsurface Geology. By Ralph E. Grim.

Bulletin 22—Preliminary Report on Bentonite in Mississippi. By Ralph E. Grim.

Nebraska Geological Survey:

Bulletin II, Second Series—The Fusulinidae of the Pennsylvanian System in Nebraska. By Carl O. Dunbar and G. E. Condra.

Ohio Geological Survey:

Fourth Series Bulletin 33—Mineral Industries of Ohio. By J. A. Bownocker and W. Stout.

Oklahoma Geological Survey:

Bulletin 44—Age Relation of the Carboniferous Rocks of the Ouachita Mountains of Oklahoma and Arkansas. By Hugh D. Miser and C. W. Honess.

Bulletin 12—Preliminary Report on the Geology of the Arbuckle and Wichita Mountains in Indian Territory and Oklahoma. By J. A. Taff.

Oklahoma Geological Survey:

Circular No. 15—Physical Characteristics of the Arbuckle Limestone. By Charles E. Decker and Clifford A. Merritt.

Circular No. 16—Oklahoma, the Geologists' Laboratory. By Chas. N. Gould.

Pennsylvania Topographic and Geological Survey:

Bulletins:

94—High Spots in Pennsylvania. By George H. Ashley.

M6, Part III—Coal Resources—Bituminous Coal Fields of Pennsylvania. By John F. Reese and James D. Sisler.

M10—Fire Clays of Pennsylvania. By J. B. Shaw.

M11—Molding Sands of Pennsylvania. By R. W. Stone and American Foundrymen's Association.

Virginia Geological Survey:

Bulletins:

28—Fenstern in the Cumberland Overthrust Block in Southwestern Virginia. By Charles Butts.

29—The Geology of the Virginia Triassic. By Joseph K. Roberts.

West Virginia Geological Survey:

Bulletin 3—The Cheat Mountain Coal Field of Randolph County, West Virginia. By David B. Reger.

County Reports, 1927—Hampshire and Hardy counties.

County Reports, 1914—Kanawha County.

Alberta Scientific and Industrial Research Council: Eighth Annual Report of the, 1927.

Argentina, Ministerio de Agricultura de la: Publicacion No. 35—Datos Hidrologicos del Desierto de Atacama. Por Luciano R. Catalano.

Publicacion No. 36—Estatdistica de Petroleo de la Republica Argentina durante el ano 1927.

Australian Museum: Records of the, Vol. XVI, No. 5, No. 6.

Canada Department of Mines, Mines Branch: Silica in Canada, Its Occurrence, Exploitation and Uses, Part II, Western Canada. By L. Heber Cole.

Great Britain Department of Scientific and Industrial Research:

Memoirs of the Geological Survey, England. The Geology of the Country near Hastings and Dungeness. By H. J. Osborne White.

Wells and Springs of Somerset. By L. Richardson.

Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for the Year 1927. Part I.

The Geology of the Country Around Woodbridge, Felixstowe and Orford.

Holland Leidsche Geologische Mededeelingen, Deel II—Aflevering 4.

Italian-Ministero Della Economia Nazionale, Rome: Relazione sul Servizio Minererio nel 1926.

Japan Geological Institute:

Some Carboniferous Fossils Collected in Manchuria and Korea. By Y. Ozawa.

The Ikuno-Akenobe Metallogenetic Province. By T. Kato.

Ordovician Fossils from Korea and South Manchuria. By T. Kobayashi.

The Optical Analysis of Volcanic Rocks as a Means of Studying Their Genetical Relationship. By S. Tsuboi.

Mexico, Instituto Geologico de:

Boletin Num. 47—Cefalopodos del Jurasico Medio de Oaxaca y Guerrero.

Mexico Secretaria de Industria, Comercio y Travajo:

Boletin del Petroleo, Vol. XXV, Num. 1, Num. 2, Num. 3.

Boletin Minero, Tomo XXV, Num. 3, Num. 5.

New Zealand Geological Survey Branch:

Bulletins:

31—The Geology of the Tongaporutu-Ohura Subdivision, Taranaki Division. By L. I. Grange.

32—Minerals and Mineral Substances of New Zealand. By P. G. Morgan.

Nova Scotia Department of Public Works and Mines:
Report on the Mines, 1927, Part I, Part II.

Nova Scotian Institute of Science:

The Proceedings and Transactions of the, Vol. XVI, Parts 1, 2, 3, 4.

Ontario Department of Mines:

Natural Gas in 1926 and Petroleum in 1926. By R. B. Harkness.
36th Annual Report, Vol. XXXVI, Parts I, II, III and IV.

Philippine Journal of Science, Vol. 35, No. 1, No. 4.
Rio de Janeiro Museu Nacional: Boletim, Vol. IV, No. 1.
Rio de Janeiro Bibliotheca Nacional: Boletim Bibligraphico Da, Anna IV, N. 1–2.
South Australia Department of Mines: Mining Review for the Half-Year Ended December 31, 1927.
South Australia Geological Survey: Bulletin No. 13—Pigment Minerals in South Australia. By R. Lockhart Jack.
Transvaal Chamber of Mines: Thirty-eighth Annual Report, Year 1927.

U. S. S. R. Scientific-Technical Department:

Transactions of the Institute of Economic Mineralogy and Metallurgy No. 34—Research Work of the X-Ray Department.
No. 33—The Refractory Clays of the Ural. By M. O. Clerc.
No. 36—Wolchonskoite. By L. V. Pustovaloff.
No. 37—Petrographical Description of the Valley of Soimonovsk. By E. A. Kouznetsow.
No. 38—On Some Rocks of Krivoi Rog and the Possibility of Their Application in Industry. By V. V. Arshinov and B. J. Merenkov.

Societies and Educational Institutions

California, University of: Vol. 17, No. 6—Geomorphology of the Southwestern San Gabriel Mountains of California. By William J. Miller.
No. 7—A Recent Volcanic Eruption Near Lassen Peak, California. By Howel Williams.
No. 8—Geology of Blackhawk Canyon, San Bernardino Mountains, California. By A. O. Woodford and T. F. Harriss.
Minnesota, University of: The Influence of Standardizing Agencies in Education. By F. J. Kelly.
Nevada, The Mackay School of Mines: Vol. XXII, No. 2—Dumortierite.
Tohoku Imperial University, Sendai, Japan: The Science Reports of the, Vol. IX, No. 3.
Academy of Natural Sciences of Pennsylvania, Year Book, 1927.
American Philosophical Society: Proceedings of the, Vol. LXVII, No. 1.
American Society of Mechanical Engineers, The: The Engineering Index, 1927.
American Bureau of Metal Statistics: Year Book of the, 1927.
American Geographical Society, The: The Geographical Review, Vol. XVII, 1927. Vol. XVIII, No. 1.
Australian Museum, Records of the, Vol. XVI, No. 4.

California Academy of Sciences: Proceedings of the:

XXII—Descriptions of Two New Species of Fishes from off Cape San Lucas, Lower California. By Barton Warren Evermann and H. Walton Clark.
XXIII—Report of the President of the Academy for the Year 1927. By C. E. Grunsky.
XX—Notes on New or Rare Fishes from Hawaii. By David Starr Jordan, Barton Warren Evermann and Shigeho Tanaka.
XVI—Index to Vol.
Occasional Papers of the, XIV—The Rudistids of Southern Mexico. By Robert H. Palmer.

Canadian Institute of Mining and Metallurgy: The Canadian Mining and Metallurgical Bulletin, Nos. 193, 194, 195.

Cleveland Museum of Natural History: The Status of the Great White Heron and Wurdemann's Heron. By Ernest G. Holt.
Engineers' Society of Western Pennsylvania: Proceedings of the, Vol. 43, No. 9; Vol. 44, No. 1, No. 2, No. 3, No. 4, No. 7.
Field Museum of Natural History: Publication 248, Vol. VII, No. 2—Annual Report of the Director for the Year 1927.
Illinois State Museum, 1877–1927 "Its Fifty Years of Service." By A. R. Crook.
Institution of Mining and Metallurgy, Bulletin of the, No. 282, No. 281.
Institution of Petroleum Technologists: Considerations on the Vapour-Phase Oxidation of Aromatic Hydrocarbons and of Petroleum Distillates.
Mining and Metallurgical Society of America: Bulletin 194—Resumé of the Minutes of the Executive Committee Meeting, April 25, 1928.
195—May-June, 1928.
San Diego Society of Natural History: Vol. V, No. 9—West Coast Species of Hinnites. By Hoyt Rodney Gale.
10—Notes on the Vaqueros and Temblor Formations of the California Miocene with Descriptions of New Species. By Lionel William Wiedey.
11—The Trimorphodon (Lyre Snake) of California, with Notes on the Species of the Adjacent Areas. By Laurence M. Klauber.
12—A New Echinoid from the California Eocene. By Hubert G. Schenck.
Western Society of Engineers: Journal of the, Vol. XXX, No. 10; Vol. XXXIII, Nos. 1, 2, 3, 4, 5, 6.

Maps

Ohio Geological Survey: Map Showing Mineral Industries of Ohio.
Virginia Geological Survey: Topographic Map of the State of Virginia.
Illinois State Geological Survey: Revised Edition of Geologic Map of Equality—Shawneetown Area.

Topographic Maps:

Albany, N. Y.
Berwyn, Ill.
Blossburg, Pa.
Carmel, N. Y.-Conn.
Chatsworth, Cal.
Claremont, Cal.
Covina, Cal.
Dry Canyon, Cal.
Gilbert, W. Va.-Va.-Ky.
Godley, Texas.
Indian Stream, N. H.-Vt.
La Brea, Cal.
La Verne, Cal.
Lemon Cove, Cal.
Liberty, Ill.
Los Angeles, Cal.
Memphis, Tenn.-Ark.
Meramec Spring, Mo.
Mount Rainier, Wash.
Mullens, W. Va.
Paxton, Ill.
Philippi, W. Va.
Pineville, W. Va.
Puente, Cal.
Puako, H. T.
Rochester, Mining District, Nev.
Topanga Canyon, Cal.
Wolfeboro, N. H.
Zelzah, Cal.
Zephyr, Texas.

Current Magazines on File

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

American Petroleum Institute, New York.
Architect and Engineer, San Francisco.
Arizona Mining Journal, Phoenix, Arizona.
Asbestos, Philadelphia, Pennsylvania.
Brick and Clay Record, Chicago.
Bulletin, Union Oil Co., Los Angeles.
California Journal of Development, San Francisco.
Cement, Mill and Quarry, Chicago, Illinois.
Chemical-Engineering and Mining Review, Melbourne, Australia.
Engineering and Mining Journal, New York.
Explosives Engineer, Wilmington, Del.
Financial Insurance News, Los Angeles, California.
Graphite, Jersey City.
Journal of Electricity and Western Industry, San Francisco.

Metallurgical and Chemical Engineering, New York.
Mine and Quarry, Chicago.
Mining and Engineering Record, Vancouver, B. C.
Mining and Oil Bulletin, Los Angeles.
Oil Age, Los Angeles.
Oil and Gas Journal, Tulsa, Oklahoma.
Oil and Gas News, Kansas City.
Oil News, Galesburg, Illinois.
Oildom, New York.
Oil, Paint and Drug Reporter, New York.
Oil Trade Journal, New York.
Oil Weekly, Houston, Texas.
Petroleum Age, New York.
Petroleum Record, Los Angeles.
Petroleum World, Los Angeles.
Queensland Government Mining Journal, Brisbane, Australia.
Rock Products, Chicago, Illinois.
Safety News, Industrial Accident Commission, San Francisco.
Salt Lake Mining Review, Salt Lake City, Utah.
Southwest Builder and Contractor, Los Angeles.
Standard Oil Bulletin, San Francisco.
Stone, New York.
The Record, Associated Oil Company, San Francisco.
Through the Ages, Baltimore.
Underground, San Francisco.

Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.
Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).
Barstow Printer, Barstow, Cal.
Blythe Herald, Blythe, Cal.
Bridgeport Chronicle-Union, Bridgeport, Mono Co., Cal
Calaveras Prospect, San Andreas, Cal.
California Oil World, Los Angeles, Cal.
Cloverdale Reveille, Cloverdale, Cal.
Colusa Daily Sun, Colusa, Cal.
Daily Commercial News, San Francisco, Cal.
Daily Midway Driller, Taft, Cal.
Del Norte Triplicate, Crescent City, Cal.
Exeter Sun, Exeter, Cal.
Gateway Gazette, Beaumont, Cal.
Goldfield News, Goldfield, Nevada.
Guerneville Times, Guerneville, Cal.
Healdsburg Enterprise, Healdsburg, Cal.
Humboldt Standard, Eureka, Cal.
Inyo Independent, Independence, Cal.
Inyo Register, Bishop, Cal.
Ione Valley Echo, Ione, Cal.
Lake County Bee, Lakeport, Cal.
Mining and Financial Record, Denver, Colo.
Mountain Democrat, Placerville, Cal.
Mountain Messenger, Downieville, Cal.
Nevada Mining Press, Reno, Nevada.
Oatman Mining News, Oatman, Arizona.
Oregon Observer, Grants Pass, Oregon.
Oroville Daily Register, Oroville, Cal.
Petroleum Reporter, Taft, Cal.
Placer Herald, Auburn, Cal.
Plumas Independent, Quincy, Cal.
Plumas National Bulletin, Quincy, Cal.
Randsburg Times, Randsburg, Cal.
San Diego News, San Diego, Cal.
Shasta Courier, Redding, Cal.

Siskiyou News, Yreka, Cal.
Stockton Record, Stockton, Cal.
Tuolumne Prospector, Tuolumne, Cal.
Ventura Daily Post, Ventura, Cal.
Weekly Trinity Journal, Weaverville, Cal.
Western Sentinel, Etna Mills, Cal.



PRODUCERS AND CONSUMERS

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

When the publication of MINING IN CALIFORNIA was on a monthly basis, current inquiries from buyers and sellers were summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to the present quarterly publication of MINING IN CALIFORNIA, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes,' and sent to those on the mailing list for MINING IN CALIFORNIA.

EMPLOYMENT SERVICE

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate attention.

Technical men, or those qualified for supervisory positions, and vacancies of like nature, only are registered, as no attempt will be made to supply common mine and mill labor.

Registration cards for the use of both prospective employers and employees may be obtained upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded. Parties interested should communicate direct with our San Francisco office.

PUBLICATIONS OF THE DIVISION OF MINES AND MINING

During the past forty-eight years, in carrying out the provisions of the organic act creating the former California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the office of the Division of Mines and Mining, in the Ferry Building, San Francisco; New Orpheum Building, Los Angeles; Capitol Extension Building, Sacramento; Redding; Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the above offices and enclosing the requisite amount in the case of publications that have a list price. Only coin, stamps or money orders should be sent, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the Division of Mines and Mining.

REPORTS

Asterisks (**) indicate the publication is out of print.

	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks	----
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks	----
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks	----
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks	----
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks	----
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. Henry G. Hanks	----
**Part II, 1887, 222 pp., 36 illustrations. William Irelan, Jr.	----
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Irelan, Jr.	----
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustrations. William Irelan, Jr.	----
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Irelan, Jr.	----
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Irelan, Jr.	----

REPORTS—Continued

Asterisks (**) indicate the publication is out of print.

	Price
Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps. William Irelan, Jr.	$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps. J. J. Crawford	----
**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford	----
Chapters of the State Mineralogist's Report, Biennial Period, 1913–1914, Fletcher Hamilton:	
**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper	----
Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper	.50
Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper	.25
**Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pages, paper	----
Mines and Mineral Resources of Imperial and San Diego Counties, 113 pp., paper	.35
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper	----
**Fourteenth Report of the State Mineralogist, for the Biennial Period 1913–1914, Fletcher Hamilton, 1915:	
A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth	----
Chapters of the State Mineralogist's Report, Biennial Period, 1915–1916, Fletcher Hamilton:	
**Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp., paper	----
**Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama Counties, 91 pp., paper	----
Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper	.65
Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper	.65
Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties, 136 pp., paper	.50
**Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp., paper	----
**Fifteenth Report of the State Mineralogist, for the Biennial Period 1915–1916, Fletcher Hamilton, 1917:	
A General Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp., 413 illustrations, cloth	----
Chapters of the State Mineralogist's Report, Biennial Period 1917–1918, Fletcher Hamilton:	
Mines and Mineral Resources of Nevada County, 270 pp., paper	.75
Mines and Mineral Resources of Plumas County, 188 pp., paper	.50
Mines and Mineral Resources of Sierra County, 144 pp., paper	.50
Seventeenth Report of the State Mineralogist, 1920, Mining in California during 1920, Fletcher Hamilton: 562 pp., 71 illustrations, cloth	1.75
Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with January, 1922:	

REPORTS—Continued

Asterisks (**) indicate the publication is out of print. Price

**January, **February, March, April, May, June, July, August, September, October, November, December, 1922 — Free

Chapters of Nineteenth Report of the State Mineralogist, 'Mining in California,' Fletcher Hamilton and Lloyd L. Root. January, February, March, September, 1923 — Free

Chapters of Twentieth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly. January, April, **July, October, 1924, per copy — $0.25

Chapters of Twenty-first Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly.

January, 1925, Mines and Mineral Resources of Sacramento, Monterey and Orange counties — .25

April, 1925, Mines and Mineral Resources of Calaveras, Merced, San Joaquin, Stanislaus and Ventura counties — .25

July, 1925, Mines and Mineral Resources of Del Norte, Humboldt and San Diego counties — .25

October, 1925, Mines and Mineral Resources of Siskiyou, San Luis Obispo and Santa Barbara counties — .25

Subscription, $1.00 in advance (by calendar year, only).

Chapters of Twenty-second Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly.

January, 1926, Mines and Mineral Resources of Trinity and Santa Cruz counties — .25

April, 1926, Mines and Mineral Resources of Shasta, San Benito and Imperial counties — .25

July, 1926, Mines and Mineral Resources of Marin and Sonoma Counties — .25

October, 1926, Mines and Mineral Resources of El Dorado and Inyo counties, also report on Minaret District, Madera County — .25

Chapters of Twenty-third Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly.

January, 1927, Mines and Mineral Resources of Contra Costa County; Santa Catalina Island — .25

April, 1927, Mines and Mineral Resources of Amador and Solano counties — .25

July, 1927, Mines and Mineral Resources of Placer and Los Angeles counties — .25

October, 1927, Mines and Mineral Resources of Mono County — .25

Chapters of Twenty-fourth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly.

January, 1928, Mines and Mineral Resources of Tuolumne County — .25

April, 1928, Mines and Mineral Resources of Mariposa County — .25

Chapters of State Oil and Gas Supervisor's Report:

Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume) — Free

Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:

**April, **May, June, **July, **August, **September, **October, November, **December, 1919 — Free

January, February, March, April, **May, June, July, **August, September, October, November, December, 1920 — Free

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January, February, March, April, May, June, July, August, September, October, November, December, 1923 — Free

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**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.) ----

**Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations ----

Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations $0.50

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**Register of Mines, with Map, Inyo County ----
**Register of Mines, with Map, Kern County ----
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**Register of Mines, with Map, Mariposa County ----
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**Map of Forest Reserves in California ----
**Mineral and Relief Map of California ----
**Map of El Dorado County, Showing Boundaries, National Forests ----
**Map of Madera County, Showing Boundaries, National Forests ----
**Map of Placer County, Showing Boundaries, National Forests ----
**Map of Shasta County, Showing Boundaries, National Forests ----
**Map of Sierra County, Showing Boundaries, National Forests ----
**Map of Siskiyou County, Showing Boundaries, National Forests ----
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Map of Copper Deposits in California .05
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These maps are revised from time to time as development work advances and ownerships change.

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DETERMINATION OF MINERAL SAMPLES

Samples (limited to three at one time) of any mineral found in the state may be sent to the Division of Mines and Mining for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

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DIVISION OF MINES AND MINING

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FOR THE PURPOSE OF FURTHERING
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FOURTH BIENNIAL REPORT

OF THE

DEPARTMENT OF INSTITUTIONS

OF THE

STATE OF CALIFORNIA

Two Years Ending June 30

1928

EARL E. JENSEN, Director
LEROY R. BRUCE, Secretary

68648

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LETTER OF TRANSMITTAL

Hon. C. C. Young,
Governor of California,
Sacramento, California.

My Dear Governor: It is with a great deal of pleasure that I, in compliance with the law, submit this report of the activities of the Department of Institutions for the biennial period June 30, 1926, to June 30, 1928.

The Department of Institutions, as you know was without a director for the first eight months of the period covered by this report, and consequently the report, with the exception of the statistical data, individual reports of the institutions, etc., must necessarily be only for the period since my appointment as your Director of Institutions.

Immediately upon my taking office, I outlined and personally conducted a complete survey of the department and the several institutions coming under its jurisdiction, and proceeded immediately to put into effect a reorganization program which I felt, from close observation, was necessary for the efficient, economical and humanitarian functioning in every phase of departmental activity.

A serious need of reorganization in the departmental office was seen. The records were incomplete and statistical data available were insufficient upon which to evaluate the results of the work done or upon which to predicate a program for the future. The work which had been done was lacking in detail, showing the absence of close coordination, which is so vitally necessary for the proper functioning of so important a department of the state government.

A plan was worked out and put into effect, which is proving most satisfactory. While we have not created divisions within the department, the plan, as operating, is primarily one of divisions; there being, under the present working plan, nominally the following divisions: Secretarial, accounting, psychiatric, parole, dietetic, deportation, industries and production, statistical, personnel and private institutions, each of which has a particular function in connection with the administration of the department. All are functioning with the exception of the personnel division, which has not as yet been completely organized.

The staff of the departmental office consists of fourteen persons, there being only three employees who were with the department at the commencement of the biennial period.

General.

The six state hospitals, two homes for the feeble-minded, three correctional schools, State Narcotic Hospital and Industrial Home for the Adult Blind, thirteen institutions in all, are correlated under the Department of Institutions.

The department has been completely reorganized, enabling closer supervision and contact with the institutions. Bimonthly conferences

are held with the superintendents and business managers, and semi-annually with superintendents, business managers, social service and placement officers. Such meetings have proven a forward step in promoting harmony, good will and a general understanding and appreciation of each others problems.

As an economic measure a supervising dietitian has been employed. The supervision of food production, preparation and service, as well as diet, has already established the economic value of such supervision, in point of both the direct benefit to the inmate, the saving of food and elimination of waste.

Cafeteria service has been, or is being installed in institutions. Such service has proven economical in some eastern institutions and is so proving in California institutions.

As a safeguard to the health of the inmates, pasteurization of all milk has been undertaken. Institutions with herds have installed pasteurizing equipment and those without herds buy only pasteurized dairy products for institution use. As an additional safeguard, semi-annual tuberculin tests are applied to all state-owned herds and known tubercular reactors are promptly eliminated.

Realizing the necessity of putting all institutional industries upon a more economic and increased production basis, a trained supervisor of industries and production has been employed. Farm production will be increased, adding variety to diets and creating surpluses for distribution among our institutions. Industries will be reorganized for more economic management and maximum production.

Research and study of our own particular problem has been encouraged. All institutions are engaged in some particular line of this activity. A new research laboratory, for service to state institutions, will be established on the grounds of the Agnews State Hospital. This laboratory will be complete in every detail and will render a great service to our state institutions.

Out-patient, or traveling clinics, have been established in centers of population. To these clinics questionable cases are brought, preventative measures are taught, advice and counsel given, resulting in many adjustments and rehabilitation without necessity of commitment to a state institution. These clinics extend their services to discharged and paroled inmates.

The private institutions of the state have been put upon a standardized basis. Rules and regulations have been established, a general policy adopted and all private institutions are required to render a service equivalent to that rendered by state institutions.

Additional social service, placement and parole workers have been employed; thus an increased number of paroles and discharges has been made possible. More suitable placement can be made, closer check and supervision of those on parole and discharge is possible, with a noticeable decrease in number returning to institutions.

For the first time in the history of the department, complete records of inmates on placement and parole, as well as those discharged, are available in the departmental office. Progress being made in each individual case is thus of record.

A survey of the institutional personnel has been made, resulting in a standardization of salaries throughout the department. The

standards of employment have been raised, undesirables eliminated, better housing and recreation provided; all making for a better type of employee and service.

All forms of mechanical restraint have been abolished. Abuse in any form will not be tolerated. Offenders have been discharged from the service and some have had criminal charges preferred against them. Restraint and abuse are things of the past.

All buildings for which funds have been provided have been completed, or are well under way and will be completed by the end of the biennium. A definite building program has been adopted for the future that will provide for the proper housing of the natural biennial increase and which will, in ten years, eliminate excess population in state institutions.

As another safeguard to the life of our wards, fire prevention has been given close attention. Added equipment has been placed at the institutions, special instruction in fire prevention and kindred subjects given, and trained fire fighting crews organized. Smoking in state buildings housing inmates has been prohibited.

A mental hygiene survey has been projected. This program is to determine whether or not the state is meeting the need in its care and treatment of the mentally ill, defective and delinquent.

Mental Hospitals.

The six mental hospitals, with a capacity of 12,194, have 13,797 inmate population. On July 1, 1926, this group had a population of 12,712 with a capacity of 11,790, showing for the two years just completed an increase of 1085 in population and an increase of 404 in capacity of the institutions. During this period 5133 were discharged as compared with 4345 for the two-year period just preceding.

On July 1, 1926, over 800 patients in state hospitals were sleeping on the floor. Today no patient is required to sleep on the floor, beds and bedding having been provided for all state wards.

All forms of mechanical restraint have been abolished. Hydrotherapy, through the providing of adequate equipment, has been substituted with marked results.

Occupational therapy has been increased by adding necessary buildings, personnel and equipment. This gives every able-bodied inmate the opportunity of some suitable occupation and aids in his rehabilitation.

Outdoor exercise and sunshine, at least four hours per day, weather permitting, has been ordered for all ambulatory patients. Invalid patients are also given the benefit of sunshine and fresh air. A program of organized recreation and amusements for inmates has been established in all institutions.

Overcrowding has been a most serious handicap in state institutions. To relieve this situation in the southern hospitals 170 patients were, during the biennium, transferred to the Mendocino State Hospital. Four hundred and sixty-four insane have been deported since July 1, 1926. Nonresident insane are returned to their native states as fast as legal residence can be established, thus relieving the crowding of institutions and relieving the state of their care.

Tubercular patients of all state hospitals have been and in the future will be transferred to the Patton State Hospital where special quarters

and tubercular units have been established. Eventually, all tubercular insane will be segregated at Patton where they will have the benefit of the dryer, warmer climate, the special quarters and specialized care.

Certain types of the criminal insane, and those requiring special custodial care, have been transferred to Mendocino State Hospital where a special unit for the housing of 66 of this class has been provided. Additional accommodations will necessarily have to be provided.

It has been decided to place a limit of 3000 on inmate population of all state hospitals. This is the maximum population at which an institution of this kind can be efficiently and economically handled.

Homes for the feeble-minded.

The two homes for the feeble-minded—the Sonoma State Home and Pacific Colony—with a capacity of 2238, have an inmate population of 2364, with 952 on parole. On July 1, 1926, this group had a capacity of 2096 with an inmate population of 2113, and 684 on parole; showing an increase for the two years just past of 142 in capacity, 251 in population and 268 in paroles. During this same period, 193 were discharged as against 64 for the two year period just preceding. There are 810 applications on file for admission to Sonoma and 239 at Pacific Colony.

At the Sonoma State Home the building program calls for a new and modern hospital building with a bed capacity of 100. Also buildings to increase the capacity of the institution.

An orthopedic surgeon has been added to the service of the home, operating on many of the crippled and deformed, giving these children better use of their limbs and reducing the amount of personal care that had been necessary.

The social service staff has been increased in view of the necessity of placing as many as possible of the higher grade cases on the outside. The increase in this staff is an economic saving to the state, and the supervision rendered enables many difficult cases to become self-supporting and noninstitutional cases. Illustrating this point, 198 cases on industrial parole in San Francisco Bay district cost the state $5,626.85 in supervision last year, but represent a saving to the state of $27,153.24, due to their being outside the institution during that year. This group's earnings for the year were $47,520.

Pacific Colony was reopened May 18, 1927, receiving inmates direct from courts and accepting the survivors of the Playa Del Rey Home, a privately owned and operated institution, which was destroyed by fire with heavy loss of life among the inmates.

Correctional Schools.

The three correctional schools—Preston School of Industry, Whittier State School and Ventura School for Girls—with a capacity of 1055 have a population of 1096, with 1130 on parole. On July 1, 1926, this group had a capacity of 1055, a population of 1066 and 948 on parole. This shows an increase of 30 in population and 182 in paroles.. During the two-year period just ended, there were 1858 received and 1642 discharged and 1396 paroled, as compared with 1862 received and 1597 discharged and 1168 paroled for the two-year period just preceding.

Specialized vocational training is being stressed at all institutions of this group. Thoroughly trained, certified, and competent vocational instructors are being employed. This instruction is in addition to the regular classroom instruction through the grades and high school. All instructors in classroom work are persons with state certificates. The boy or girl is given training in the vocation for which best suited. This special vocational training fits the boy or girl for proper and suitable placement, and in an environment where he or she may make good.

A building program has been inaugurated to increase capacity of both institutions for boys, obviating the necessity of so many boys being held in county jails, sometimes for weeks or months, awaiting admission to the schools.

Difficulty is being experienced in the handling of the older and hardened type of boy. This fact is a strong argument for an intermediate institution, correctional type, a need which the department has long realized and has been studying for some time.

Segregation into smaller groups, under housemothers, simulating home environment, atmosphere and conditions has been attempted and is proving successful and an aid to rehabilitation.

Research into the causes and prevention of juvenile delinquency has become a feature in this group, and through this department of the schools much is done in the individual case, assisting in the eventual rehabilitation of the boy or girl.

The state has been divided into districts for the more efficient and economic functioning of parole and placement workers. There is therefore no duplication of effort. Better supervision and placement is a result and consequently fewer returns.

Industrial Home for the Adult Blind.

The Industrial Home for the Adult Blind, under the new policy of making it a training institution instead of a combined training and custodial institution, is meeting the immediate need in an adequate manner. However, a survey of the blind in the state is just being completed which will determine the need of this group for training, care and supervision and financial aid.

Display and sales room for products of the blind are planned to stimulate interest, put the products before the buying public, encourage the blind themselves, and assist them through proper training to become self-supporting.

State Narcotic Hospital.

Leading authorities in the United States on the question of drug addiction and its treatment were interviewed prior to the establishment of this institution. Methods of treatment were studied, as well as suitable medical personnel.

An institution for the care and treatment, under the superintendency of the outstanding available authority on this subject, was established on the old Pacific Lodge property at Spadra. An emergency appropriation of $100,000 was necessary, as the legislature of 1927 provided no funds for this purpose.

The institution is to open in July of 1928 with a capacity of fifty. During the coming biennium it is planned to increase the size of this

institution to enable its care of a larger number of addicts. All persons suffering from drug addiction and really desiring treatment and cure will be benefited. The outlook for this institution is most promising and optimistic. This work has the interest of the public and cooperation of the courts.

Inmates are given the best of scientific care and treatment and required to remain in the institution a minimum of eight months. Inmates are apparently happy and decidedly grateful to the state for what is being done for them. All patients in convalescent stage are required to perform some occupation. Orchard and garden work and trade instruction will be features of occupational activities.

Placement at expiration of term in some established employment with after care and supervision are expected to make a majority of the cures effected complete and lasting.

California is the first state to attempt the experiment of establishing a narcotic hospital for the care, treatment and ultimate rehabilitation of drug addicts.

Improvements.

Among the many improvements made during the last two years at our various state institutions are the following:

AGNEWS STATE HOSPITAL

Completed During Biennium.

Industrial building for women.
Purchase of 130 acres of land for farming purposes.
Ward building for patients.
Building for employees.
Electrical and plumbing shops.
Deep well pump and pump house at farm colony.
Reconstruction of buildings and pens at hog ranch.
Addition of two wings to open air cottage.
Two deep well turbine pumps at farm colony.

Projects Under Way but Uncompleted on June 30, 1928.

Two residences for physicians.

MENDOCINO STATE HOSPITAL

Completed During Biennium.

Bunk house for farm employees.
Nineteen rooms for employees added in main building.
Two ward buildings for patients.
Three wards in main building rebuilt and remodeled.
Purchase of 126 acres of land for farming purposes.
Installed pasteurizer at dairy.
Rebuilt farm foreman's residence.
Two new wells and pumps for domestic and irrigation supply.

Projects under way but uncompleted on June 30, 1928.

Building for employees.
Ward building for patients.
Residence for physician.
Separate custodial unit for criminal insane patients.

NAPA STATE HOSPITAL

Completed During Biennium.

Nurses home.
Blacksmith shop.

Bunk house for dairy employees.
Main pipe line for fuel oil.
Purchase of 249 acres of land for farming purposes.
Garages for 98 employees' automobiles.
Farm cottage at Coombs ranch.
Installed pasteurizer at dairy.

Projects Under Way But Uncompleted on June 30, 1928.

Ward buildings for female patients.
Building for employees.
Residence for physicians.
Addition to laundry building.

NORWALK STATE HOSPITAL

Completed During Biennium.

Two ward buildings for 240 patients.
Receiving and treatment building for 140 patients.
Building for 48 night employees.
Three residences for physicians.
New cement walks, 15,300 feet.
New and complete poultry plant.
Replacement of old septic tank.
New well and pump for irrigation.

Projects Under Way but Uncompleted on June 30, 1928.

Assembly hall and chapel for patients.
Additional new warehouse.

PATTON STATE HOSPITAL

Completed During Biennium.

New complete laundry building and equipment.
Two ward buildings for patients.
Remodeled two wards for tubercular patients.
New septic tank.
New boiler installed and old boilers repaired.
Five employees' cottages.
Two pumps and pump house.
Garage for 72 employees and state automobiles.
Installed pasteurizer.

Projects Under Way but Uncompleted on June 30, 1928.

New kitchen commissary, bakery, cold storage and dining room building.
Special group, building for tubercular patients.

STOCKTON STATE HOSPITAL

Completed During Biennium.

Two ward buildings at farm for 240 patients.
New boiler at dairy.
New steam lines to serve main building.
Three fire escapes for male and female patients' building.
Renewed roof of main female building.
New boiler, female department, power house.

Projects Under Way but Uncompleted on June 30, 1928.

Three ward buildings at farm for 360 patients.
Two residences for physicians.
Patients' industrial building.
Grading and paving of Harding way.
Water mains and sprinkler system at farm.

PACIFIC COLONY

Completed During Biennium.

Two ward buildings for 160 patients.
Complete boiler plant building.

Boiler equipment and steam service lines.
Road system installed.
Kitchen, commissary, bakery, cold storage and dining room building. Complete with equipment.
Laundry building and complete equipment.
Residence for superintendent.
Subway under railroad grade.
Bridge over San Jose creek.
New well and pumping equipment.
Installed pasteurizer.

Projects Under Way but Uncompleted on June 30, 1928.

Two ward buildings for 160 patients.
School and gymnasium building.
Carpenter, shoe shop and boys' training building.
Reservoir for water storage.
Building and garages for employees.

SONOMA STATE HOME

Completed During Biennium.

One ward building for patients.
Cottage for patients at poultry colony.
Addition to sewage disposal plant.
Garages for employees' automobiles.
New poultry houses and hog pens at farm.
Installed pasteurizer.

Projects Under Way but Uncompleted on June 30, 1928.

Complete new general hospital building.
Building for employees.
New boiler installation.
Water mains and pump for domestic and fire protection system; also additional sewage facilities.

VENTURA SCHOOL FOR GIRLS

Completed During Biennium.

Laundry building and equipment.
Painting all buildings.
Pasteurizer installed.
Repair and improvement of electric pole lines.
New cement walks and cement tennis courts.

PRESTON SCHOOL OF INDUSTRY

Completed During Biennium.

Garages for 29 employees' and state automobiles.
Farm cottage, horse barns and corrals at Riley ranch.
Water mains and syphon pipes installed.
Replaced old brick making plant.
New hog house and fences.
New bakery oven and remodeling of bakery.
New boiler installed and old boilers rebuilt.

Projects Under Way but Uncompleted on June 30, 1928.

Purchase of 51 acres of land for farming purposes.
Hospital and receiving building.
Class room building.
Custodial unit for boys requiring special custodial care.
Dormitory building for younger boys.
Dam and dam site for water supply.

WHITTIER STATE SCHOOL

Completed During Biennium.

Remodeling buildings in research group.
Residence for assistant superintendent.
Addition to school building.
New well and pump.
Buildings at Catalina summer camp.
New athletic field.
Cafeteria installed.
New general shop and building construction trades equipment installed and buildings remodeled for same.
Printing shop equipment.
Remodeling of boys' buildings.

Projects Under Way but Uncompleted on June 30, 1928.

Administration building.
Two buildings for boys.
General hospital building.
Remodel old hospital for employees' quarters.

INDUSTRIAL HOME FOR THE ADULT BLIND

Completed During Biennium.

Extension of steam heat to broom factory.
Roads and walks in institution's grounds.
New floor in assembly hall.
Addition of one story to basket shop building.

Projects Under Way but Uncompleted on June 30, 1928.

New roof on broom shop building.
New equipment and repair to broom shop building.
New pump installation in well.
Repairs and enlargement of ice plant.
Steam lines.

STATE NARCOTIC HOSPITAL

Projects Under Way but Uncompleted on June 30, 1928.

Remodel building completely and equipping the same to house narcotic patients.
Well and pumping equipment.
Septic tank.
Hydrotherapy equipment.
Heating and hot water storage equipment.
Barracks building for convalescent patients.

Conclusion.

Recognition is due the splendid cooperation of the several superintendents and their respective staffs and employees, as well as my own staff, the Departments of Finance and Public Works, the Civil Service Commission, and other agencies who have, in many ways, contributed to the successful administration of this department.

In conclusion, I wish to thank your Excellency for your broad and sympathetic knowledge and understanding of our particular problem and your wholehearted cooperation which has made possible the new policy and the many improvements in our institutions and their service to the wards of the State of California.

Respectfully submitted.

EARL E. JENSEN,
Director of Institutions.

July 1, 1928.

Statement of Income and Expenditures

(July 1, 1926, to June 30, 1927)

Seventy-eighth Fiscal Year

INCOME

Appropriations		$65,399 87
Support, chapter 30, 1925	$37,051 34	
Salaries, chapter 30, 1925	16,407 41	
Emergency Resolution No. 18, chapter 30, 1925	11,941 12	
License fees, private institutions		2,675 00
Total income		$68,074 87

EXPENDITURES

Current year's expenditures as per following statement	$65,347 77
Prior year's expense; seventy-seventh fiscal year	52 10
Contributions to general fund	2,675 00
Total expenditures	$68,074 87

Administration	*Materials and supplies*	*Salaries and wages*	*Service and expense*	*Property and equipment*	*Total*
Director		$1,612 91			$1,612 91
Secretary		3,056 45			3,056 45
Deportation		3,000 00	$41,477 38		44,477 38
Supervision private inst.		1,633 33			1,633 33
Clerical and office	$135 86	7,104 72	381 81	$1,389 59	9,011 98
Printing	1,013 64				1,013 64
Telephone and telegraph			475 58		475 58
Postage			473 00		473 00
Traveling			2,068 76		2,068 76
Automobile	295 16		214 08	1,015 50	1,524 74
Total administration	$1,444 66	$16,407 41	$45,090 61	$2,405 09	$65,347 77

Statement of Financial Status

(As of June 30, 1927)

Seventy-eighth Fiscal Year

FUNDING GROUP

Available appropriated funds	$13,717 68	Appropriations—	
		Support, Chap. 30, 1925	$932 76
		Salaries, Chap. 30, 1925	11,726 04
		Emergency Resolution No. 68	58 88
		Reserve for revolving fund	1,000 00
Total	$13,717 68	Total	$13,717 68

PROPRIETARY GROUP

Warrants receivable	$8,416 64	Claims filed	$8,416 64
Revolving fund	1,000 00	Liability for revolving fund	1,000 00
Property and equipment, actual as of June 30, 1927	7,175 19	Accountability for property and equipment	7,175 19
Total	$16,591 83	Total	$16,591 83

TRUST GROUP

General fund, Department of Institutions			
Unclaimed trust money fund—special	$8,737 35	Unclaimed patients' personal deposits	$8,737 35
Total	$8,737 35	Total	$8,737 35

Statement of Income and Expenditures

(July 1, 1927, to June 30, 1928)

Seventy-ninth Fiscal Year

INCOME

Appropriations		$56,625 31
Support, chapter 30, 1925	$624 50	
Support, chapter 142, 1927	56,000 81	
License fees—private institutions		2,200 00
Total income		$58,825 31

EXPENDITURES

Current year's expenditures, as per following statement	$56,000 81
Prior year's expense	624 50
Contribution to general fund	2,200 00
Total expenditures	$58,825 31

Administration	*Materials and supplies*	*Salaries and wages*	*Service and expense*	*Property and equipment*	*Total*
Director		$5,924 72			$5,924 72
Secretary		3,225 00			3,225 00
Assistant secretary		2,820 00			2,820 00
Deportation		3,000 00	$21,364 77		24,364 77
Supervision private inst.		1,410 97	372 74		1,783 71
Dietitian		662 07	239 44		901 51
Supervisor state use and provision		500 00	268 15		768 15
Clerical and office	$240 61	7,462 56	839 81	$298 37	8,841 35
Printing	608 57				608 57
Telephone and telegraph			1,190 08		1,190 08
Postage			475 06		475 06
Traveling			4,280 21		4,280 21
Automobile	259 35		473 46	84 87	817 68
Totals	$1,108 53	$25,005 32	$29,503 72	$383 24	$56,000 81

Statement of Financial Group

(As of June 30, 1928)

Seventy-ninth Fiscal Year

FUNDING GROUP

Available appropriated funds	$26,757 09	Appropriations—	
		Support, chapter 30, 1925	$308 26
		Salaries, chapter 30, 1925	12,726 04
		Emergency Resolution No. 68 chapter 30, 1925	58 88
		Support, chapter 142, 1927	12,313 91
		Reserve for revolving fund	1,350 00
Total	$26,757 09	Total	$26,757 09

PROPRIETARY GROUP

Revolving fund	$1,350 00	Claims filed	$6,306 35
Warrants receivable	6,306 35	Liability for revolving fund	1,350 00
Property and equipment as of June 30, 1928	7,573 25	Accountability for property and equipment	7,573 25
Total	$15,229 60	Total	$15,229 60

TRUST GROUP

General fund, Department of Institutions			
Unclaimed trust money fund—special	$4,484 95	Unclaimed patients' personal deposits	$4,484 95
Total	$4,484 95	Total	$4,484 95

REPORT OF DEPORTATION AGENT

MR. EARL E. JENSEN, *Director,*
Department of Institutions.

DEAR SIR: In reporting the activities of this branch of the service for the past biennium there are no unusual incidents to record. The accompanying tables supply the detailed data. From a perusal of Table No. 1 you will note that of the 183 aliens deported by the federal authorities 88, or 47 per cent, were Mexican nationals. Of this number 62 per cent were admitted to our state hospitals in southern California and it is in this section of the state where the problem of caring for the defective, delinquent and destitute of the Mexican race is most acute. During the biennium just closed, 208 patients of Mexican birth were admitted to our state hospitals in southern California. As stated above 88 were deported to Mexico by the Federal Immigration Service, hence there remains a considerable number in our institutions. It is the belief of the writer it would be a humanitarian act to enter into negotiations with the proper Mexican officials, through our state department, with a view to obtaining their permission to return some of these unfortunate people to their native land, where they will be among people of their own temperament and language. I have in mind considering only those of a mild mental type who are inoffensive and can be cared for in the homes of their relatives or friends.

Attention is drawn to the large number of deportations from the Preston School—364; which represents 28 per cent of the commitments to this institution. While this institution is always crowded to over capacity, by deportation it has been enabled to receive commitments from the large urban districts, whence a majority of the delinquents originate, thus relieving, to some extent, the county jails, which are improper custodial institutions for delinquents of this type. It is our sincere hope that with the return of these prodigals to their homes there will result a material salvage in young manhood, thereby justifying the liberal expenditure of the funds of our state.

The federal government, through its Department of Labor-Immigration Service, continues its active cooperation. We are pleased with its recent ruling that an alien who becomes a public charge within the statutory period of five years may be deported at any time regardless of the length of time in this country.

The following table shows the number of aliens and nonresidents deported from the several institutions during the biennium:

	Aliens	*Nonresidents*	*Total*
Stockton	29	48	77
Napa	23	38	61
Agnews	11	18	29
Mendocino	7	17	24
Patton	64	124	188
Norwalk	24	53	77
Sonoma	1	7	8

	Aliens	*Nonresidents*	*Total*
Preston	24	361	385
Whittier	--	1	1
Ventura	--	5	5
Totals	183	672	855

Respectfully submitted.

CHAS. F. WAYMIRE,
Deportation Agent.

TABLE No. 1

Nativity of Aliens Deported During the Biennium

By United States Immigration Service

Canada	10	Jugo-Slavia	5
Central America	1	Mexico	88
Denmark	4	Norway	1
England	6	New Zealand	1
France	1	Portugal	1
Greece	1	Russia	3
Germany	17	South America	4
Holland	1	Spain	3
India	2	Scotland	5
Ireland	5	Sweden	4
Italy	13	Switzerland	4
Japan	3		
Total			183

TABLE No. 2

Time in the United States of Aliens Deported During the Biennium

1 to 6 months	2	21 to 24 months	11
6 to 12 months	23	24 to 30 months	15
12 to 15 months	14	30 to 36 months	14
15 to 18 months	9	36 to 48 months	31
18 to 21 months	11	48 to 60 months	53
Total			183

TABLE No. 3

July 1, 1926, to June 30, 1928

Deported on U. S. government warrants	182
Deported by relatives	1
Cases held pending litigation	2
Cases under investigation	42
Cases with negative results	6
Total	233

TABLE No. 4

Showing Deportations Since September, 1915

Nonresidents returned to their home	2,840
Aliens deported by federal authorities	775
Chinese returned to China	251
Japanese returned to Japan	71
Total	3,937

TABLE No. 5

Showing the Financial Benefits Derived by the State Through the Efforts of the Department of Institutions

	Aliens deported and nonresidents returned	Per capita cost of maintenance	Saving based on cost of maintenance	Per capita cost for construction, furnishing, etc.	Saving based on cost of construction, etc	Total based on cost of maintenance construction, etc	Expense of deportation	Net saving to the state
1905	10	$156 37	$1,563 70	$550 00	$5,500 00	$7,063 70	$1,200 00	$5,863 70
1906	15	150 35	2,255 25	550 00	8,250 00	10,505 25	1,200 00	9,305 25
1907	8	163 32	1,298 56	550 00	4,400 00	5,698 56	1,200 00	4,498 56
1908	15	165 08	2,476 20	550 00	8,250 00	10,726 20	1,200 00	9,526 20
1909	27	163 03	4,401 81	750 00	20,250 00	24,651 81	1,200 00	23,451 81
1910	63	180 02	11,341 26	750 00	47,250 00	58,591 26	1,200 00	57,391 26
1911	63	176 50	11,119 50	750 00	47,250 00	58,369 50	1,200 00	57,169 50
1912	44	167 70	7,378 80	750 00	33,000 00	40,378 80	1,200 00	39,178 80
1913	39	177 24	4,912 36	750 00	29,250 00	34,162 36	1,200 00	32,962 36
1914	146	189 47	27,662 62	750 00	109,500 00	137,162 62	12,925 00	124,237 62
1915	27	189 59	5,118 93	750 00	20,250 00	25,368 93	1,200 00	24,168 93
1916	175	183 52	32,116 00	750 00	131,250 00	163,366 00	18,700 00	144,666 00
1917	123	198 87	24,461 01	750 00	92,250 00	116,711 01	13,500 00	103,211 01
1918	201	222 09	44,640 09	1,000 00	201,000 00	245,640 09	12,600 00	233,040 09
1919	144	257 40	37,065 60	1,000 00	144,000 00	181,065 60	12,600 00	168,465 60
1920	304	289 54	88,020 16	1,000 00	304,000 00	392,020 16	20,700 00	371,320 16
1921	198	303 20	60,033 60	750 00	148,500 00	208,533 60	20,700 00	187,833 60
1922	266	277 47	72,807 02	750 00	199,500 00	272,307 02	29,210 00	243,097 02
1923 Insane	236	280 00	66,080 00	750 00	177,000 00			
Delinquents	12	638 22	7,658 64	750 00	9,000 00	259,738 64	24,680 00	235,058 64
1924 Insane	293	259 63	76,071 59	750 00	219,750 00			
Delinquents	148	561 54	83,107 92	750 00	111,000 00	489,929 51	36,880 00	453,049 51
1925 Insane	308	263 00	81,004 00	850 00	261,800 00			
Delinquents	214	574 68	122,981 52	850 00	181,900 00	647,685 52	43,621 99	604,063 53
1926 Insane	296	254 81	75,423 76	850 00	251,600 00			
Delinquents	177	592 68	104,904 36	850 00	150,450 00	582,378 12	36,231 90	546,146 22
1927 Insane	241	251 35	60,575 35	850 00	204,850 00			
Delinquents	235	600 63	141,148 05	850 00	199,750 00	606,323 40	45,101 88	561,221 52
1928 Insane	223	254 64	56,784 72	850 00	189,550 00			
Delinquents	160	636 13	101,780 80	850 00	136,000 00	484,115 52	33,251 14	450,864 38
Totals	4,411		*$1,416,193 18		$3,646,300 00	$5,062,493 18	$372,701 91	$4,689,791 27

* This column merely shows the saving for one year. A conservative estimate of the average institutional life of an insane person is ten years, and that of the delinquents is 18 months. On this basis we estimate the next saving to the State on maintenance at $9,015,788.52.

DIETITIAN'S REPORT

FOOD CONDITIONS, DEPARTMENT OF INSTITUTIONS

A preliminary food survey in the twelve institutions in the Department of Institutions revealed conditions which were not only interesting but alarming as well. Meals served to inmates consisted at times of food with notably high carbohydrate content, a dinner of macaroni, potatoes, and beans was not a rare occurrence, but sometimes a usual one. Wheat bread as a further source of carbohydrate was consumed in greater quantities than graham or whole wheat bread. In the matter of food preparation there was lacking a thoroughness which can only accompany well cooked food. Cereals were thrown in a steam pot and processed only thirty minutes, beans were steamed less than two hours, the resulting product not even having the starch broken down into poly or disaccharids. Meat on the other hand was violently boiled without braising until every atom of extractives was boiled out and the meat left a colorless, flavorless gray rubbery product. Vegetables, too, subjected to steam were turned out in huge quantities with little or no regard for flavor, texture or palatability.

Routine menus were in use; i.e., beans were served regularly every Tuesday, beef every Thursday, and so on. The monotony of steam cooked food, the psychological effect of routine menus, and improper preparation both by over and under cooking food resulted in plate and general garbage waste, which surpassed even the expectations of a liberal estimate.

Ranch and dairy products were delivered to the kitchen irrespective of time, quality, quantity, or demand. More specifically, tons of string beans were delivered one week; tons of chard the next. Further, due to inadequate storage space the vegetables had to be left on delivering platforms and were subjected to the heat of the sun, and the dew of the night from which they naturally enough became dehydrated and mouldy. In one institution the milk after pasteurization had a peculiar flat, colorless taste. It was found that even though pasteurized at 145 degrees and held for thirty minutes, it was not rapidly cooled to 70 degrees, hence, all of the flavors were not recovered.

In the patients' dining rooms the food service was not properly supervised. While attendants were always present at meal time, their function was one of watchful waiting while some patients made a meal of bread and syrup, others of potatoes and meat. A condition of grave concern is the lack of dining room space both for large congregate groups and small groups on the ward. In some instances patients must eat in dark corridors, poorly lighted halls, and even in close proximity to lavatories. Not only are the surroundings unstimulating but in what condition, at best, can the food be after it leaves a subkitchen and is served on trays which must be carried various distances by one attendant who has at least ten or twenty patients to wait on? The food is lukewarm, generously slopped over the tray, and wholly unappetizing.

Most of the kitchens are in run-down condition, sadly neglected, and distressingly in need of paint. Due to the fact that all of the patients' cooking is done by steam, and that insufficient effort is made or poor fan systems have been installed, the steam does not leave the kitchens quickly; a film is deposited on the wall which becomes streaked and shadowy. The kitchen equipment is fairly modern, as far as it goes, but in quantity and variety does not begin to measure up to the increased population that it must care for.

Sanitary conditions are not the best. Even though the walls of the kitchens be dingy, effort may be directed on keeping equipment spotless, and if not glittering at least without a greasy smear which is familiar to almost all. Cockroaches and ants are not without representation, to the indifferent concern of those whose duty it is to supervise the well being of an institution. Drainage is poor, ice boxes inadequate. Little consideration has been taken of the wash room and toilet facilities for kitchen help; this matter is a grave one since serious contamination, even infection, may result. In the dairies the problem of sanitation, or lack of it, can not be overemphasized, since milk is a most susceptible food toward foreign material of any kind and when patients come in from the corrals, and are in direct contact with open buckets of milk, it seems hardly possible that danger may be averted.

Briefly, that is the situation as the dietitian found it beginning her services with the state some eight months ago. What has been done in the line of constructive improvement? The carbohydrate meals have been relieved by the introduction of fresh fruits and vegetables, which are easily available from local grounds. Meals at which baked beans and potatoes were served are taboo. When beans are served every effort is made to introduce a fresh bulky vegetable such as spinach, chard, or lettuce. Particular effort is being directed toward proper preparation of food so that raw soggy food, unbraised meat, unseasoned vegetables do not leave the kitchen in such a condition. Raw vegetables—carrots, onions, lettuce, tomatoes, cabbage are being introduced into the diet, thus supplying vitamine, mineral and bulk. Whole wheat bread and rolls are baked much to the delight of the patients. It is the ultimate aim to serve well-balanced meals.

It is the present endeavor to make improvements, regardless, using whatever there is to work with. Thus steam cooking is still in predominance, but by keeping the available bake ovens in use constantly, it is possible to reach a few wards at a time with roasted meats, baked vegetables, and so on, thus introducing to a very small extent variety in food preparation. All food is tasted by the dietition before it leaves the kitchen, and the efforts in introducing change are most gratifying since the patients do not hesitate to express their delight in a varied diet.

Routine menus are a thing of the past, their use is strictly prohibited. Nothing is more deadening and institutional than to know that each day brings a set menu. Inmates and employees have expressed their pleasure regarding this.

Since the dairy and ranch are so closely related to the kitchen, effort has been made to correlate them so that they may be of real service to each other. Conferences are scheduled between the chef and farm foreman. It is then possible for the chef to order the vegetables as he

needs them and the farmer to state his production and a ways and means agreed upon whereby surplus may be utilized. The chef has been instructed to plan his menus covering a week's period. Thus he may plan his work ahead and proceed in a logical fashion, heretofore haphazard. The farmer, too, knowing what is wanted in the kitchen for such a period may plan his work also and make proper arrangement to avoid useless waste, through overproduction and careless selection of old neglected produce unfit for table use. In recommendations to superintendents, attention has been called to the apparent lack of supervision in the patients' dining rooms. There has been a marked improvement here and with efforts being directed toward having patients served with each kind of food prepared, and encouragement given to eat it, at least proper support is being given toward seeing that the patients eat what is prepared for them.

As far as dining room space is concerned, the only immediate control there is of that, is to make conscientious efforts to improve the tray service and hurry meals to the patients that they might enjoy them while warm.

Keeping kitchens and equipment clean and free from vermin is not a matter of eight or ten days' effort—the usual length of the dietitian's stay in an institution. Constant war on uncleanly conditions can only bring kitchens up to standard.

What further improvements can be anticipated in the future? It has been the policy to "do the best we can with what we have to work with." Progress, then, is necessarily limited. There must be more equipment, particularly roasting ovens, whereby food may be prepared in various ways, become more palatable, result in less plate waste. Chopping machines, too, for the preparation of raw vegetables in large quantities are badly needed.

It is my opinion that the dairies should be more closely supervised by some one who has made a specialty of that work, as it is quite evident there is much room for improvement.

In the building program that is submitted every year the following needs should be thoroughly investigated: Canneries, dining rooms, kitchen ventilation, lavatory and toilet facilities, store room. In some institutions canning of surplus vegetables and fruits is carried on in the kitchen, resulting in much confusion and serious interference with food preparation. This is a distinct industry and should be entirely divorced from kitchen procedure. The necessity for this can not be overemphasized. Balanced diets, well prepared food is of little or no value if suitable dining room space is not provided to lend color and cheerful surroundings to patients. Furthermore, the present situation in which patients are crowded in hallways, and must eat from trays, is disgraceful. Under proper direction fanning systems and air vents can be installed so that steam need not streak kitchen walls and make them dingy and unattractive in less than no time. Lavatory and toilet facilities must be improved and further investigated, since they are entirely inadequate. Storage space for vegetables is badly needed.

Recommendation is made for increase of dairy products for patients, particularly to eggs and milk. For the most part only on holidays do patients get eggs. It is desired that they be served several times a week to round out a breakfast, which at this time consists only of cereal,

fruit, bread and butter and coffee. Taking into consideration the working group of patients, this meal is inadequate.

Cafeteria plan of food service has been attempted in one of the institutions and has met with particular success. While fundamentally the same food is used, it is apparently enjoyed 100 per cent more, and waste is reduced one-third if not one-half. The psychological effect of seeing the food nicely displayed, and having a choice even though limited, is marked indeed. Further service of this kind is heavily endorsed.

The effort of the dietitian is to have nourishing food well prepared. Should consideration be given to suggestions and continued cooperation be obtained, there is no reason why meals served in California institutions should not be of the best.

REPORT OF MEDICAL SUPERINTENDENT OF AGNEWS STATE HOSPITAL

Mr. Earl E. Jensen,
Director of State Institutions,
Sacramento, California.

Twenty years ago we began replacing the destroyed Agnews Asylum for the insane with a hospital for the mentally ill.

It was then thought that to best serve its purpose such a hospital should not be so large as to collect in one community too large a number of patients of too varied conditions. It was determined there should be an acute center of limited capacity first constructed, later to be supplemented by an adjunct community segregated from the parent institution but under its administration and an integral part of it. Accordingly a general scheme was adopted and specific plans made for a hospital for 1000 beds. This scheme and building plans have been adhered to.

However, because the necessity for additional housing became so great before a supplemental plant could be established, more or less temporary extension has been made so that with temporary provision and excessive overcrowding the number now housed is 2000. Though still of opinion 1000 should have been the maximum for the receiving, acute, and psychopathic center, 1250 will have to be accepted, and should not be increased, as the proper housing when temporary buildings are abandoned and overcrowded excess removed. This relief is urgent for the proper care of patients and best results in treatment.

The purchase of land last year of character and location ideal for the purpose now makes possible the extension of this hospital by a detached plant as originally planned, to give this relief and provide for additional numbers. Because of convenience to a center of large population and economy in construction, it probably will be found advisable to utilize this well adapted site on which to provide some of the urgently needed additional housing. We are glad to be able to offer this desirable method of increasing our population to the maximum fixed for our state hospitals.

If this provision for relief and increased numbers is provided, we shall then be able to use our present hospital, planned for the purpose, for the reception, study, and active treatment of new cases. A real psychophysical hospital. While our planning and construction of a physical plant for this purpose are not far amiss, and probably have not yet been excelled in structure and arrangement, still our ideas and desires have expanded, our vision has enlarged with development, our interest in psychiatry has increased, and the urge to help in the solution of its problems emboldens us to put forward plans long cherished and to ask for assistance to make Agnews something more, and more

useful. In addition to all else it is desired this hospital shall stand for, we wish very greatly to increase our equipment and facilities for investigation and research and in our budget have asked appropriation for enlarged laboratories, which also we would make useful for teaching and increasing interest in psychiatry. Such work can only be done where there is abundance of material, and material can only be had in sufficient quantity and variety in connection with a state hospital. Whatever we have done and are doing with our present facilities we feel restricted and desire greater opportunity to do psychophysical research. We think we are modest and reasonable in our request which is not up to the measure of our desire. I also believe the abnormal is the door through which we are to arrive at a better understanding of normal mental action. I know the great and increasing need for more housing, but are we to go on and on and on simply housing without attempting to stem the increasing tide of mental conditions requiring more room? Humanity and economy demand greater effort shall be made to prevent and restore at whatever cost necessary, while at the same time adequate provision for housing is provided.

Our plan is to use the hospital we have with its facilities and such additions thereto as may be found desirable, without increasing its capacity, for study, teaching, and treating, while the supplementary institution with its fertile land shall furnish beneficial employment with a further chance for readjustment if the patient is not restored by hospital treatment. The number necessary to permanently detain should greatly lessen and many of these can be made productive with comfort and with as much out of life as their capacity will permit.

We can only expect what can be given us, but if we can have sympathy for our plans and our endeavors, and as much as may be possible to advance them, we shall go forward with courage and enthusiasm.

Our estimated needs for support, upkeep, betterments, expansion and provision for more advanced and better service are made known to you in our budget requests.

Services rendered and results during the biennium are very well shown in the statistical part of our report. To be especially noted among the permanent improvements of the period are a new building for patients, one for employees, addition for occupational therapy, a new building for mechanics and the acquisition of additional land making possible the development of extensive vegetable gardens and rendering practicable the extension of this hospital. We have expanded and advanced very greatly in occupational and recreational therapy, continuing our medical and laboratory work with increasing interest and effort.

We enter upon a new biennium with greater confidence of producing desired results because we do so with more adequate personnel and better equipment, and because we feel assured of your sympathetic interest and assistance.

At present our excessively overcrowded condition is our greatest handicap.

LEONARD STOCKING,
Medical Superintendent.

REPORT OF THE MEDICAL SUPERINTENDENT OF MENDOCINO STATE HOSPITAL

EARL E. JENSEN,
Director of Institutions,
Sacramento, California.

SIR: I have the honor to submit herewith the following report covering the biennium ending June 30, 1928.

PATIENT POPULATION

The population of the hospital on July 1, 1926, was 740 men and 386 women, total 1126. On June 30, 1928, the population was 867 men and 429 women, total 1296, there being an increase for the two years of 170 patients. There were 170 insane first admissions during this period, 29 insane readmissions, 88 transfers from other hospitals and 4 intemperate cases admitted on voluntary commitments. The total of admissions of all types was 423. Our rate of commitment during this period remained about the same until the latter portion of 1928, at which time the commitments were markedly increased due to the fact that we received quite a number from Los Angeles County and from the San Francisco Bay vicinity in order to relieve the congested condition in the other state hospitals.

There were employed in the hospital on June 30, 1928, 173 men and 14 women in the various industries, including the ranch and its different departments, landscape gardens, laundry, kitchens, bakery, mechanical department, sewing room and art room. Aside from this, work is found for patients on the wards whose age or physical condition unfits them for more strenuous forms of labor. It is felt that occupation, in one form or the other, is of greatest benefit to the patients, as it not only hastens their return to normalcy, but in keeping them occupied, they are apparently more contented.

During the past biennium the remodeling of the original wards in the hospital has been completed, making these quarters more cheerful, better ventilated, and simplifying the housekeeping methods.

The two wards, one male and one female, which were constructed about 1910, have also been entirely renovated, including the plumbing, plastering, painting, and have been rendered more habitable. The female cottage, formerly used as one ward, has been divided into two wards, one on the second floor occupied by women who work in industries, and the one on the first floor by invalided cases and those requiring special medical attention. These quarters are well adapted to the uses to which they are being put. This cottage is surrounded by a large yard shaded with native oak trees, also ornamental trees, and has recently been planted to lawn with wide walks. This has materially added to the comfort of such patients occupying this exercise area.

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LEONARD STOCKING,
Medical Superintendent.

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NEW CONSTRUCTION

Cottages G and H were completed during the summer of 1927 and have proved themselves to be of a very satisfactory type. These are both of 86 capacity for women patients. It was decided not to transfer from other hospitals to fill these two buildings, but to request commitments to this institution rather than to those that were overcrowded. We have been receiving the additional commitments but, to a large majority, they have been male patients. Therefore, at the present time, Cottage H is unoccupied.

The Custodial Building is practically completed and should be occupied by October, 1928. Quarters in this building consist of single rooms only, and will at present hold 66 patients. The day room, dining room, water sections, however, are constructed with the idea of increasing the capacity of this building to 300 patients eventually. It has also been decided to put a cafeteria in the unit, as it is felt that this is the most satisfactory method of feeding patients of sufficient mental capacity to cooperate. The grounds about the building will have to be landscaped with patient labor as the money for this work is not available in the appropriation.

The Attendants' Building is under construction and will house 80 persons, two to the room. It should be ready for occupancy during October, 1928. These quarters should be duplicated during the next biennium, as the present capacity is insufficient for our needs.

The new Physician's Cottage has been begun and will probably be ready for occupancy some time in September, 1928.

The Women's Building of 120 capacity provided for in the last budget, has not yet been begun, but plans and specifications are under way. This building will be of the same type of architecture as Cottages G and H, the Receiving Building and Custodial Building. Appropriations for further buildings at this institution will be requested of the next legislature in approximately the same amount as that allowed by the last legislature, which will increase the capacity of the institution approximately 350 patients.

PERMANENT IMPROVEMENTS OTHER THAN THOSE FOR CARE AND WELFARE

A well 16 inches by 78 feet was dug and turbine pump of 385 gallons per minute capacity was installed. This well is for domestic use.

A complete set of recording instruments were added to the boilers and these promote economy in operation.

Two motor driven extractors and two motor driven presses were added to the laundry equipment.

ADDITIONAL LAND

The piece of land known as the Clark Ranch was purchased during the past fiscal year, adding better than 100 acres to the hospital area under cultivation. This land lies along the Russian River, is known as river bottom land, is of very high productivity and, with proper handling, ought to make large returns to the state.

PERSONNEL

Dr. S. H. Babington was appointed to the medical staff on July 19, 1926, and resigned on December 31, 1927.

Dr. L. J. McMahon, pro rata dentist, resigned on June 30, 1927, to devote his entire time to the Sonoma State Home. Dr. Donald A. Frost was appointed on July 1, 1927, to fill the vacancy.

Dr. Elizabeth Ward Tock resigned on September 15, 1927, and Dr. R. Eva Rawlings was appointed to her position on October 1, 1927.

Dr. R. O. LeBaron, first assistant physician, resigned on December 22, 1927.

Dr. Lee E. Smith was appointed on January 24, 1928, and resigned on May 1, 1928.

Dr. Leonard Galton was appointed on May 2, 1928.

We have been one physician short on the staff for six months prior to June 30, 1928, due to the difficulty of getting satisfactory men to fill the positions vacated by Dr. LeBaron and Dr. Babington. We expect to fill that vacancy, however, within the next thirty days by a man who has had sufficient experience to be thoroughly familiar with this type of work and who has been interviewed by the superintendent. He should fill the position satisfactorily. The last budget made provision for an additional physician after July 1st. We are hoping to get a man for this position who can take over the pathological work of the institution, one who is equipped to do modern pathology, since we feel that the institution is now large enough to require one whose entire time would be devoted to this work. We have ample material, and correct pathological data is essential to the proper treatment of cases.

BUSINESS MANAGER'S DEPARTMENT

The seventy-eighth fiscal year farm production was $60,069.12, net profit $30,575.58, while the seventy-ninth fiscal year production was $56,020.52, net profit $19,011.83.

Much loss was experienced in the dairy herd on account of tuberculosis and infectious abortion.

Rotation of crops is being practiced and greatly increased yields are resulting.

DONALD R. SMITH,
Medical Superintendent.

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Much loss was experienced in the dairy herd on account of tuberculosis and infectious abortion.

Rotation of crops is being practiced and greatly increased yields are resulting.

DONALD R. SMITH,
Medical Superintendent.

REPORT OF MEDICAL SUPERINTENDENT OF NAPA STATE HOSPITAL

MR. EARL E. JENSEN,
Director of Institutions,
Sacramento, California.

DEAR SIR: I have the honor to submit herewith the following biennial report of the Napa State Hospital, covering the biennial period ending June 30, 1928.

CLINICAL WORK

The regular staff meetings for the discussion of diagnoses, treatment of recently admitted patients, leave of absence and discharge, reexamination of those who have returned from leave of absence or who have returned to be considered for a discharge as "recovered," are held three times each week. The total number of appearances before these conferences during the biennium was 3465.

PATIENTS UNDER TREATMENT

At the beginning of the fiscal year (July 1, 1926), there were in the institution 2845 patients. For the two year period we received a total of 1501, making the number under treatment for the two year period 4346.

RESULTS OF TREATMENT

During the biennial period 407 patients were discharged as "recovered," 442 as "improved," 91 as "unimproved," 35 "not insane," 55 transferred, 848 on leave of absence. Alcoholics, sentence expired 35; sentence unexpired 47; narcotics, term expired 14; term unexpired 19.

NEW LEGISLATION—FUNDS FOR PAROLE PATIENTS

I recommend that the law authorizing the superintendent to advance certain funds to patients on their discharge, be so amended as to include parole patients. At times there are men and women who can be granted parole but not discharge who have no relatives or friends and require funds for their transportation and for their expenses until they find employment.

TREATMENT OF ACUTE DISTURBED PATIENTS

Our facilities for the treatment of this type of men and women have been inadequate. It is to be expected that with the construction of the new acute disturbed cottage that this type will be better cared for.

PATHOLOGICAL DIVISION

Fifty-seven postmortems have been made during the past biennium, and some of the material has been sent to the laboratory at Agnews State Hospital as this institution has no pathologist. When a patient is admitted to this hospital, as a routine measure, we obtain a specimen of blood and urine. The Wassermann test and complete blood count are made and the results of this routine work are reported to the physician in charge. The patients who show positive blood Wassermann are given a Lumbar Puncture and examination of the spinal fluid. All patients having a negative Wassermann but with a history of syphilis, are given another blood Wassermann. This is in addition to a spinal fluid examination.

MALARIAL TREATMENT FOR SYPHILIS

During the past few months we have been using the malarial treatment for cases of general paralysis. Before inoculating the patients with Plasmodium Malaria, we obtain permission from their nearest relative. Both men and women patients have been given this form of treatment. It is as yet too early to make a report upon this treatment, but from the success that has been achieved in other hospitals, we expect good results.

The attention which these patients require from a mental and physical aspect makes them the most expensive group from a nursing standpoint of any class of patients in a mental hospital. It would seem that anything that promises a lessening of these processes would be an economical advantage.

SURGICAL OPERATIONS

The surgery of the institution is considerable and varied in character as might be expected in a community of over 3000 persons. Our surgeon, Dr. C. A. Johnson, with the assistance of members of the staff, throughout the past biennium, has performed the following operations:

Laparotomies:	
Female sterilizations	10
Female sterilizations with major operations (appendectomies, salpingectomies, and hysterectomies)	59
Exploratory laparotomies	4
Appendectomies (alone)	2
Breast amputations	5
Tonsillectomies and adenoidectomies	12
Gynecological (trachelorrhaphy-colporrhaphy perineorrhaphy)	14
Male sterilizations	91
Hemorrhoidectomies	14
Hernia	8
Variocele and hydrocele	2
Epithelioma of hip	2
Minor surgery (boils, sebaceous cysts, injuries, removal of warts, etc., not included in above compilation).	
Total surgery operations	223
Luetic treatments (neo-arsphenamine and tryparsamide)	1540

X-RAY

Whenever a patient's history mentions a head injury, the skull is X-rayed to determine whether or not there is any pathology present

which might have some bearing on the patient's mental condition, and X-rays of the chest, intestinal tract and other conditions when indicated.

HEALTH

Throughout the biennium, employees and patients have maintained an excellent health record with the exception of the typhoid epidemic of March, 1927. Our laboratory, working in conjunction with the State Board of Health, made laboratory examinations of all food handlers of the institution. It was found that one of the milkers at the dairy was a suspect. All the patients of the institution, excepting the aged and feeble, have been inoculated with typhoid and paratyphoid vaccine, as a precautionary measure. Routine tests of stools, water and milk were made.

A pasteurizer was installed April 10, 1928, and work is now going on for the installment of a chlorinator for the domestic water supply of the institution.

As a preventative measure, typhoid and smallpox vaccines are administered to all newly admitted patients under 60 years of age whose physical health will permit.

TUBERCULAR PATIENTS

On January 22, 1928, six men and seven women were transferred to Patton State Hospital. At the present time we have four men and ten women.

DENTAL DIVISION

Every effort is made to correlate the work of this division with that of the other divisions of medical service. The teeth of all newly admitted patients are examined. Amalgam and cement fillings, extractions and cleaning of teeth.

RESTRAINT

During the last year of the biennium all mechanical restraint has been done away with.

QUARTERLY CONFERENCES OF MEDICAL SUPERINTENDENTS

As medical superintendent, I have attended the quarterly conferences at Patton, Sonoma, Stockton, Whittier and Ventura.

OCCUPATIONAL THERAPY DIVISION

We have in this division many who do not attend the class but who carry on work on the wards such as housekeeping and similar duties, under the direction and supervision of the attendants. Groups of men and women work in the laundry and cannery; men on the farms, in the dairy, kitchen, bakery, greenhouse, on the grounds and in the different mechanical shops. The ward physicians assign them to their different occupations and those having them in charge are closely supervised. Inducements in the form of extra diet and special privileges are granted to stimulate activity.

Of the men, we have employed today in these departments 345, 290 of them having parole privileges of the grounds. Two hundred nineteen

are employed on different wards and in different buildings of the institution.

Of the women, 189 are employed in ward work and other activities connected with the different units of the hospital, and 182 are employed off the wards in the laundry, kitchen, dining rooms and occupational department. One hundred sixty-seven women have parole of the institutional grounds.

Occupational departments for men manufacture fiber furniture, shoes, brushes, brooms, clothing, wearing apparel, etc. The women, all wearing apparel, art and fancy work.

ART WORK

We have made exhibits each year at the State Fair at Sacramento.

Next to useful labor, recreation and amusement are important to the mental, moral and physical welfare and improvement of the insane.

RECREATIONS AND AMUSEMENTS

Moving pictures and dances weekly; baseball games; field day and vaudeville Fourth of July; tree and presents on Christmas. We have a splendid orchestra made up of employees who furnish music at the moving pictures, dances, entertainments, and weekly on the grounds of the institution during the summer.

The grounds have been made attractive by the planting of shrubs and trees and the addition of park benches and swings for the women, and a new recreational park planted to shrubs and flowers in which benches and tables have been placed for women parole patients and visitors to the institution. Two stands have been erected for men and women patients on the baseball grounds. All patients except bedridden patients are outdoors for exercise on the grounds throughout the year from 9 to 11 a.m., and from 1.30 to 4 p.m.

During the biennium radio service to the acute quiet and infirmary cottages for men and women, the decrepit cottage for women, four wards of the female service and the occupational therapy department has been installed. We have pianos and Victrolas in several of the wards; also volley ball and quoits on the grounds for the men and croquet for the women.

LIBRARY DIVISION

The library contains 2100 volumes of fiction, etc. We are indebted to the Berkeley Free Library for several hundred of these books.

RELIGIOUS SERVICES

Catholic or Protestant services are held each Sunday for the patients of the institution.

SOCIAL SERVICE DIVISION

By the appointment of a Social Service Worker and the establishing of a Community Mental Hygiene Clinic, this institution has for the first time made a definite extension of its therapeutic functions and has established contact with the prospective patient before he has reached the stage of commitment, hoping by means of intelligent advice, readjustments of personality and surroundings may be brought about.

VISITORS TO THE INSTITUTION

Next in importance to our Social Division in educating the public are the visits to the institution of relatives, friends and others, and these visits have always been encouraged. They help many who have no knowledge of institutional life to form a better idea of the nature of the work being done in state hospitals, and thus remove an unfounded prejudice frequently entertained against institutions, and friends of the insane become willing to place them in the care of hospitals promptly after the attack and while the disease may be regarded as curable.

CONSTRUCTION WORK AND IMPROVEMENTS

The Department of Public Works during the past two years has constructed a nurses' home, blacksmith shop, extension to the laundry, quarters for dairy employees and a home for patients at the Coombs Ranch. Ground has been broken for a home for single male and female attendants and for a physician's cottage.

IMPROVEMENTS MADE BY CARPENTER

Among other improvements: 71 garages; shed for fruit workers and storage, Smith-Brown Ranch; small house 10 by 12, Spencer Ranch; storeroom for cannery; rebuilding of cannery after fire; brooder house 20 by 120, Poultry Ranch; remodeling of Juarez house.

PAINTER

Clubroom and long hall of main building; exterior and interior of the A. Q. H. Cottage; exterior woodwork dining room, reception room and six dormitories of the parole ward for men; roof of large hay barn at dairy; retarring of roofs at main dairy, shoe shop and paint shop; exterior of the farm foreman's home; exterior of the male and female infirmary; exterior of the female decrepit; 6 rooms, 2 bathrooms, 2 halls and 1 stairway, Francis Cottage; interior of cottage at poultry ranch; halls and rooms over fire house; 33 new garages; interior of machine shop; all woodwork and bases on wards "P," "T," "U" and "O"; tinted 29 rooms nurses' home; painted and enameled all walls and woodwork in hospital cottage of Dozier group; painted and enameled interior of tubercular cottage for women; painted all walls, ceilings and woodwork of No. 5 ward; painted 13 rooms, 2 long halls, dining room and pantry, bath and lavatory "A" ward; painted dining room, pantry, toilets, side corridors, dormitories and side rooms "Z" ward; 2 small dormitories, 14 rooms, 1 dining room and pantry, 3 halls, 1 day room, 23 radiators "MADC"; painted roof of amusement hall, A. Q. H., male and female infirmary, female decrepit and nurses' home; woodwork, touched up walls of "X" ward; painted and enameled cooling room of butcher shop; interior of cannery; exterior and roof of cannery; all woodwork of "W" ward and No. 3 ward; dormitory, lavatory and bath, pantry and dining room of "V" ward; lavatory and bath, pantry and dining rom, main dormitory "W" ward; interior of "M" ward; all woodwork in hall, corridor and dining room of "R" ward; interior of bakery, side rooms and equipment; exterior of 31 garages; interior of diet kitchen; sun porch and back hall superintendent's residence;

Juarez home, exterior, interior and roof; female and male attendants' dining rooms; brooder house chicken ranch; interior of laboratory; 6 rooms, 3 bathrooms and hall over A. Q. H. Cottage; interior of main kitchen; 443 beds and 176 large yard benches; hospital station at the main gate; retouched and varnished 3191 pieces of furniture.

PURCHASE OF LAND

The Juarez property adjoining the hospital, 249 acres, recently purchased by the state at a cost of $35,000. Of this acreage, 100 have been placed under cultivation and the residence has been remodeled to be occupied by the business manager.

LIVING CONDITIONS OF PATIENTS AND ATTENDANTS

To relieve the overcrowding of the female service, attendants' rooms on wards "V," "Y," "S" and "W" have been made into small dormitories with a capacity of 35. Rooms in Administration Building, third floor, made into dormitories, dining rooms and the hall used as a reception hall for parole women, with a capacity of 35. Total increase 70.

There has been a marked improvement in the general conditions in the living quarters of both attendants and patients. A new nurses home for attendants; painting of the wards and cottages; fly screening of windows; improved ventilation; 1000 pictures framed and hung on the wards, dining rooms and cottages of the institution; new fiber furniture has been placed on each ward, and all other furniture and many of the beds have been painted, some in attractive colors of blue and green. Rugs and runners have been placed on several of the wards. These improvements are reflected in the general attitude and welfare of the patients and employees.

FIRE PROTECTION AND FIRES

Fire drills are held weekly and the fire apparatus and fire alarm systems are regularly tested. The present apparatus is of excellent type, $4,779.37 having been expended during the biennium as follows:

12 wharf hydrants	$115 72
46 fire extinguishers	283 90
21 feet hose	814 25
American-La France chemical fire engine	3275 00
Electric siren	208 00
3 nozzles	70 50
6 sets couplings	12 00
	$4,779 37

On July 5, 1927, the cannery of the institution was destroyed by fire with the loss of life of a patient. Property loss about $5,000.

Eighteen new exits have been made to the group of Dozier cottages, 2 to the Ogden cottage and the doors of the male and female decrepit and the Ogden cottages have been changed to open outward. The window guards of the male and female decrepit have been removed. The fire hydrants and fence of the Dozier group have been moved back as they were too close to the buildings to permit fighting a fire or the safe exit of patients from these buildings.

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RESIGNATIONS

Dr. F. L. Herrick, assistant physician, appointed March 15, 1926, resigned November 12, 1926, to reenter private practice.

Mr. Owen Duffy, business manager of the institution since July 1, 1913, resigned on April 1, 1928. Mr. Duffy was also business manager of the Napa State Farm and his duties at the farm had become such that it was necessary that he devote his full time to its management. We of the institution who had been so long associated with him and knowing his work as a business manager, regretted his resignation, and wish him every success.

APPOINTMENTS

Dr. I. E. Charlesworth, appointed assistant physician November 18, 1926.

Dr. B. M. Johnson, appointed assistant physician, November 21, 1927.

Mr. Jos. E. Robinson, appointed business manager, April 1, 1928.

Miss Eleanor Boyakin, appointed social service worker on May 10, 1928.

WATER SUPPLY

Lake Marie, our domestic supply, is holding up better than usual this season. The Spencer ranch supply is being used wholly in the laundry and for the boilers. We are doing some auxiliary pumping to augment the supply for the institution and irrigation. We are much in need of water on the Juarez ranch, and a well should be driven there in order to make effective truck gardening.

LAUNDRY

Owing to the increased burden put upon the laundry by the white uniforms for the officials and attendants, we found it necessary to request a new tumbler and presses, and they have been allowed. The fine new addition to the laundry, providing more space for the washers and help, will relieve very materially the present crowded condition. A few minor changes will greatly enhance the desirability of the structure and tend to efficiency.

ORCHARD

We have an unusually fine crop of apples and pears, and a fair crop of peaches; a smaller crop of prunes than was harvested last year. The cherry crop was not sufficient for canning.

FARM

We have threshed 3403 sacks of grain and over 400 tons of hay this year. We have a splendid crop of corn on the Juarez property and will be able to fill both the silos at the dairy this season for the first time in its history. The tomato, corn and pumpkin crops are good.

GARDEN

The garden production has been considerably extended this season by the additional acreage on the Juarez ranch, Hog ranch and the Smith-Brown properties. We are having an orderly delivery of these products to the kitchen so that the chef can determine a few days ahead

what vegetable can be depended upon from the garden. By an added water supply at the Juarez ranch we can produce a greater diversity of garden truck in sufficient quantities to meet our demands.

DAIRY

By natural growth, we have recouped the herd until it has reached the numbers that were depleted some years ago by the sale of dairy stock. We are now milking 90 cows with an average production of 4.7 gallons. In order to keep from inbreeding, it will be necessary for us to secure a new bull next year. The heifers of the sire of the herd to date are showing up splendidly, and their production of milk is much higher average than their mothers. This is the only certified or registered herd that a state institution has, and therefore is a little more expensive in operation than the ordinary herd.

HOG RANCH

Heretofore the hogs have been fattened by the Napa State Farm. This has kept the herds small in weight and numbers, and it is our endeavor now to increase the herd and not butcher them until they weigh from 180 to 200 pounds. There are close to 500 brood sows and young shoats.

POULTRY RANCH

This year has been a prolific one both in the production of eggs and the hatching of young broods. We have made a flock of about 7000 fowls, have culled out 850 old ones and about 2000 young cockerels. Without additional help and supplies, we think it would be difficult to care for more than 4500 fowls. It is our desire when funds become available to have a refrigeration room in which to store our surplus eggs and care for beans, prunes, etc. At present we are using the inner box of the butcher shop and have stored over 2100 eggs there.

SPENCER RANCH

At the Spencer ranch we have 1000 very fine turkeys, some geese and turkens.

ADVISORY BOARD

To you, the advisory board—F. L. Martin, president; W. L. Lane, C. G. McDaniel, and H. J. McCurry, who have been so generous in your endeavors for the welfare of the institution and so loyal in your support of my administration, I feel sure you all realize how much I value your friendship.

CONCLUSIONS

In bringing this report to a close, would say that I have attempted to give you a brief resume of our activities during the past biennium. Credit for the results we have achieved belongs to the physicians, matrons, supervisors, attendants and to every employee of the institution, for without their loyalty and devotion to duty, we would have failed in our efforts in caring for those committed to us.

Respectfully submitted.

G. W. Ogden,
Medical Superintendent.

REPORT OF MEDICAL SUPERINTENDENT OF NORWALK STATE HOSPITAL

MR. EARL E. JENSEN,
Director of Institutions,
Sacramento, California.

DEAR SIR: I have the honor to submit herewith my report for the biennial period ending June 30, 1928:

We have previously forwarded to you complete statistical tables compiled according to the forms prescribed by the National Committee for Mental Hygiene. In looking over these tables I wish to call attention to the large number of patients admitted to this institution suffering from general paralysis and those suffering with manic depressive psychosis. This institution receives the bulk of the very active acutely disturbed, excited and sick patients committed from Los Angeles County, making the service in this institution a very active acute service. All patients committed from Los Angeles County, due to their weakened physical condition or actively acute disturbed condition are sent to this institution on stretchers and in ambulances. This increases the work of our medical staff and our nursing force and also adds very materially to our large death rate. You will note on Table No. 13 that of the total number of deaths, which are 388, we had 108 who died after less than one month's residence.

The health of the institution has been very good and we have not been visited by any severe epidemic. Due to a case of typhoid fever which developed from an employee on one of our buildings we had occasion to make a very thorough test of our water supply and our milk supply and to have frequent examinations of all who handled our food supplies. All our employees were given a typhoid vaccine, as well as a number of the patients.

We have had little change in the medical staff of the institution, but it is with difficulty that we obtain the necessary physicians for our staff on account of the inadequate living quarters for the physicians in this institution. Physicians and their families should be comfortably housed in a cottage provided by the institution and this we are unable to provide for all our medical staff.

We have had the usual large turnover in nurses and attendants. I believe that this can be overcome by giving the nurses and attendants better living quarters away from the wards. This has been partially overcome by a building for the night employees and we are in hopes that when the other buildings are completed for the day employees that we will have our attendants' quarters so comfortable that we will not have so many changes in our nursing force. The inadequate housing facilities for employees and physicians is a great handicap in any institution. The new construction now under way for additional housing

of our nurses and attendants and additional homes for physicians will go a long way toward solving one of our most difficult problems.

The inauguration of the malarial treatment for general paralysis has helped the general welfare of this class of patients and we believe that it has increased the percentage of remissions in this form of mental trouble quite markedly from both the mental and physical aspects. The attention which these patients require makes them the most difficult class from a nursing standpoint of any patients which we have in the institution. Anything which would tend to lessen the nursing care required by these patients would be considered an economical advantage to the institution as well as a marked benefit to the patient.

As our institution is growing quite rapidly we see our wards filling with a class of chronic patients suffering with dementia praecox. Of the total number of admissions for the biennial period we find that there was admitted 286 belonging to this class of mental trouble. The outlook for their complete recovery is, of course, very poor. It is this class of patients that fill our wards and really are the problem which we consider in the overcrowded condition of our institutions. It is my opinion that this problem can be met with an increase in the therapeutic measure known as occupational therapy. Occupational therapy involves the transformation of a hospital from a more or less passive institution to an active one. Such transformation has been wrought in many of the better institutions in the east and occupational therapy, as its name implies, is a branch of medicine and should be carried out under the direction of one or more of the hospital physicians. It is my opinion that our force of occupational therapists should be increased so that we could provide classes on all of our chronic wards. These occupational teachers should have tact, intelligent sympathy, poise, dignity, ability to listen and be silent, creative ability and infinite patience. As long as a case of dementia praecox, no matter how serious, can be taught to show a faint interest in some work or occupation, there is hope that we can arouse the dormant interest and their first evidence of improvement shows their desire to produce something. We are frequently surprised by unexpected improvement in this class of patients after they have become interested in some form of occupation. In some of the eastern institutions they have their occupational therapy course divided into various grades, including habit training and kindergarten grades. A large variety of work is offered so that patients may be given suitable occupation. The instruction should be mainly individual and should be carried on to fulfil the three principal purposes of occupational therapy—to improve the patient's mental condition, to make him contented and an effective member of the hospital community and to fit him for usefulness outside of the hospital. There should also be a happy blending of work, recreation and amusement. Occupational therapy should be regarded as a part of the treatment in institutions and teachers, nurses and physicians as coworkers each having an essential part in the noble task of rebuilding broken lives.

With the improvement of our chronic mental patients with occupational therapy should go also an increase in the number of our aftercare workers to enable us to parole more patients from the institutions who are not entirely recovered. This work is both preventative and

reconstructive; the hospital keeps in closer touch with the patients and their return can be advised promptly if thought necessary.

The total acreage of this institution is 337 acres; 100 acres of this is land that can not be used for building sites and is not suitable for garden or farm use. Our need for additional land for building sites, recreation grounds, garden and farm use is quite urgent. The buildings that are just completed are as close to the main traveled boulevard as they should be and we should find sites for additional buildings to be built that will give the patients the necessary privacy, also the recreation grounds should be so situated that they will have some privacy and be away from the large numbers of visitors who come to the institution daily.

In conclusion I wish to express my cordial appreciation to the many friends of the institution, for their thoughtful donations to the patients, particularly to Mrs. W. S. James for her Christmas gifts to all the friendless patients in the institution; to the medical staff and other officers and employees I wish to extend my grateful acknowledgment for their loyal cooperation and faithfulness in the performance of their duties, without which the successful results of the past years could not have been obtained.

Respectfully submitted.

EDWIN WAYTE,
Medical Superintendent.

REPORT OF MEDICAL SUPERINTENDENT OF PATTON STATE HOSPITAL

To the Honorable Earl E. Jensen,
Director, Department of Institutions,
State of California
Sacramento, California.

My Dear Mr. Jensen: I take pleasure in submitting the following report to you for the biennium including the seventy-eighth and seventy-ninth fiscal years. During that time there have been many changes in the hospital, of which I have the honor to be superintendent: New buildings, permanent improvements to old buildings, additions and betterments to our water supply and a general and steady improvement in our buildings and landscape.

Two new two-story buildings, housing two wards of 50 patients each, have been completed. These were designed and built to care for the more disturbed and restless type of patients, equipped to give hydrotherapy and to add to the number of single rooms so that they could be cared for without restraint and without unnecessary difficulty. These buildings are much the best structures that have ever been erected at this institution, being of reinforced concrete, hollow tile inner walls and tile roofs, and are a credit to the state, affording most excellent housing for the type of patients for which they were designed.

We have remodeled two dormitories, one at the male and one at the female infirmary ward, and are using these to care for male and female tubercular patients. This is in view of the preparation for the consummation of the ultimate plan of the Director of Institutions that Patton, because of its climatic advantages, should care for all tubercular insane.

All of our old wards and cottages have been repainted, both inside and out, necessary repairs have been kept up and the buildings are in better condition than they have ever been, considering that they are moderately old structures and all of them frame construction.

During the past few months we have begun a rearrangement, renaming and lettering of our wards and cottages with the idea of eventually keeping the male patients on one side and the female patients on the other side of center, devoting letters to the male and numbers to the female. This will be an assistance to the staff in that it will shorten the amount of ground covered, which in an institution covering as large an area as ours has become very great.

This institution, like all those of its kind, has been very crowded. At the end of the biennium we had 2850 patients. At the time of writing, five weeks later, we have 2931. This means an overcrowding of approximately 20 per cent. This overcrowding does not mean that the patients are not being cared for comfortably and well, but that the space that

they are in was not intended to carry as large a proportion of beds. The worst problem which we have to face is dining room space, as a dining room built to seat 60 or 75 is very much overcrowded when seating from 80 to 100. We are carrying 200 of this number in basements, which though large, airy and well ventilated, making very comfortable housing, were never intended for that purpose.

We believe that the plan of the Director of Institutions that 3000 should be the limit of the population of any institution, is an ideal one as a larger plant becomes in a manner top heavy and is impossible of the supervision which can be given to the smaller one.

The past two years have seen many deportations from this part of the state, but with all that there has been a continuous and steady growth in population each year. This past year, with federal and state deportations and removal by friends from outside the state of more than 125 and with all the paroles, discharges and escapes, we have still increased 123 patients. It seems to me that it is highly probable that the increase of institutional populations will advance rather than decrease during the ensuing years, not necessarily because of the increase in insanity but because of the natural growth in population which we must expect in California, and because of the increasing difficulty in competitive life on the outside.

Here I want to make my plea for a new institution to be established in the southern part of the state to help relieve the congestion which of necessity will be greatest here, as south of the Tehachapi there are 4500 hospital beds in comparison with 10,000 in the northern part of the state and in this area is found from 55 to 60 per cent of the population of the state, and a much larger percentage of visitors and transients.

At the present writing we are entering the last year of the state biennium for which appropriations are made, and are at present constructing a tubercular cottage to care for fifty female patients, which is part of the construction program of the hospital. A two-story ward building is practically completed, which will care for 100 female patients and, in case of necessity, will be able to provide for another seventy-five patients in the basement which will be prepared to house them if need be. Plans are now in process of development and construction will soon start on a kitchen unit containing refrigeration, bakery and dining room for employees—a very much needed piece of construction.

We hope that in the future it will be possible for us to complete two new infirmary wards to take care of 200 women and 200 men and to take the place of McGonigle and G which are old and in a very bad state of repair and which it is impossible to rehabilitate to any great extent because of the character of the construction.

This institution has reached the place where, on account of the number of admissions during the month, it is impossible due to the small size of our Receiving Cottage, to give the new coming patients the type of care and treatment which they should receive prior to their distribution through the cottages and wards. This is a piece of construction which should be cared for in the near future and should be designed so that it may be large enough to care far many of the integral treatments of the hospital, as well as 200 resident patients. To

obtain the best class of employees we must house and care for them comfortably and pleasantly. We are very much in need of quarters for both officers and other employees. We should have quarters today for 50 more attendants and at least 3 more cottages for staff members.

We have changed our sewage system during the past year from the old system of settling tanks to the new Imhoff type, which is considered to be the most modern and up to date. The effluent from this system, after it has passed through the period of digestion, aeration and chlorinization, is used for irrigation of crops. These crops are not used for human consumption but for stock feed and the value of the water thus conserved is very great.

We have done and are continuing to do much occupational work. This includes the making of denims, shirtings, toweling, ticking and the manufacture of shoes for our institution. During the past several years we have made all the furniture used by both patients and employees. The dairy, the farm, the landscape, various household activities give employment to many outside of the industries. It is our hope that in the very near future we may increase this by those who are more deteriorated, teaching them the tasks until the time when all except those who are in bed and are unable to do anything would be given occupation of some type. In this instance we want to express our very great appreciation for the assistance which the Director of Institutions is giving us in these tasks.

This hospital, in common with most of the institutions in the state of California, has felt the pinch of water shortage. New pumps have been added to three of our wells. The Shay and Taylor ranches, which we use for intensive cropping purposes, both for truck and for stock feed, at the time of purchase had a very valuable artesian well which flowed something over 110 inches. There has been a decrease in that until at the present time the flow is only 25 inches and entirely insufficient, without the addition of a pump, to care for 150 acres of land as it must be cared for to produce results. And now plans must be made for developing new sources before the present ones are used up.

During the two years of which I write we have had several changes in the medical staff. Following the death of my predecessor, Dr. John A. Reily, on May 14, 1926, we engaged Dr. O. C. Reeve. He had had experience in New York and New Jersey and came to this institution well recommended. He was somewhat restless because of conditions here and left in the fall to return to Ohio where he accepted a position in the University Hospital. In January, 1927, Dr. H. H. Johnston came to us from the civil service list. He had never had institution employment but had practiced for several years both in the east and in the west. He remained with us until November when he left to go into practice in San Diego. Dr. Meyer, who came to this institution in 1916 from New York, and was a permanent member of the staff except during his army service, left on July 1, 1927, to enter upon his new duties of superintendent of the San Bernardino County General Hospital. On the first of September, 1927, our vacancy was filled by Dr. F. H. Garrett, who came to us from the Arkansas State Hospital. He is a graduate of the University of Arkansas and came to us very well recommended and we have had no reason to be other than satisfied with the work that he is doing and the interest that he is showing.

From the resignation of Dr. Johnston until the last of June, 1928, we were short one member on the staff. On the 28th of June this was filled by Dr. Robert E. Wyers, also a graduate of the University of Arkansas, with experience in the State Hospital in that state and in the General Hospital in Little Rock. We had a new member of the staff allowed us for the present year, and this vacancy is filled by Dr. Theodore K. Miller of Oakland.

We feel sure that now we are in position to do very much more intensive and active work than heretofore, carrying out the plan this fall of establishing clinics in nearby towns, which will care for paroles, discharged cases and will be able to take the border line cases and assist them, preventing the necessity of their entrance into an institution. This work is in accord with the desires of the Department of Institutions.

During the two years of which I write we have had no epidemics in the institution, the general health of the hospital has been good and the death rate exceedingly low. We believe we can thank the active work in medicine and surgery done by our staff for much of this good record. The careful examinations upon entrance, the followup on every patient that comes into the institution, the active treatment—physiotherapeutic medicinal and surgical, that is given to all troubles, improves the physique and with it the mental condition of those who enter.

I desire to extend my thanks and the thanks of the institution to the management of the Orange Show, which each year has cared for all the patients in the institution that are able to go, giving over to them a morning, furnishing music and entertainment. I also wish to extend our thanks to the various interests at this show that have assisted in giving the patients pleasure by donating candies and ice cream and by offering free admissions to various amusements on the "Pike."

The Riverside County Library for many years past has been giving to us once or twice a year some three hundred or four hundred books that have been taken out of circulation because of their condition. These we are able to rehabilitate and salvage and have made a great addition to our library. Reading is, with a large proportion of patients one of the first pleasures, all spare time is spent with magazines, books and papers.

We also have to thank the post office in San Bernardino for undelivered magazines and papers; the Highland Library, various lodges and social organizations that have done much to add to the pleasant pastime for our patients.

In closing I desire to express the appreciation of this institution to the Director of the Department of Institutions and to the various officials at the State Capitol for the most kindly and thoughtful help in all our needs, and to express my appreciation of the active interest that all of them, from the greatest to the smallest, have displayed in their attitude toward us.

Yours very truly,

G. M. Webster,
Medical Superintendent.

REPORT OF MEDICAL SUPERINTENDENT OF STOCKTON STATE HOSPITAL

MR. EARL E. JENSEN,
Director of Institutions,
Sacramento, California.

DEAR SIR: Here within you will find my report for the seventy-ninth and eightieth fiscal years, concerning the number of patients, the money received and expended, and the various activities about the hospital and farm.

We have completed three cottages for men at our farm and are occupying two of them. In the third cottage there is defect in the screens on the porches, and we are having this remedied before putting the patients in it.

We have at the present time 642 patients in the cottages at the farm. They all seem contented, and a great many of them are occupied in the various farm industries, such as hog raising, taking care of chickens, farming, and working in the orchard. When the other cottage is occupied, then our old building, which has been occupied since 1853, will be taken down and the bricks will be used for the erection of industrial buildings at the state hospital proper, for the carpenter, tinner, mattress maker, etc.

The fire escapes for both the men's and women's building were completed at the cost of $134.70, two new boilers have been installed in the engine room at the cost of $28,117.70. These boilers are very satisfactory and make quite a saving in our fuel consumption. We have made repairs to our power line running to our farm at the cost of $2,891.16, repairs to the roof and wards in the Women's Building amounting to $4,078.36, and repairs to the Refrigerator Building amounting to $4,764.60.

We admitted to this hospital 825 patients during the year, 570 of whom are men; 489 committed by the court, 24 alcoholics, 15 drug addicts, and 42 volunteer patients. We received 265 women, 223 committed by the court, 3 alcoholics, 4 drug addicts, and 35 volunteer patients.

Yours truly,

FRED P. CLARK,
Medical Superintendent.

STOCKTON STATE HOSPITAL

Report of Operating Room

	From July 1, 1926 to June 30, 1927	*From July 1, 1927 to June 30, 1928*
Vasectomy	111	46
Salpingectomys	34	33
Appendectomy	8	8
Breast amputation	---	1
Herniotomy	2	4
Hemorrhoidectomy	---	1
Hysterectomy	4	1
Thyroidectomy	1	3
Ligation of thyroid arteries	---	2
Ovarian cysts and oophorectomy	3	5
Tonsillectomy	12	10
Deflated septum	2	---
Excision of facial tumors	5	1
Excision of body tumors	2	1
Opening of abscesses	1	1
Suturing of wounds	3	3
Teeth extractions (under gas)	143	138
Tapping of abdomen	0	1
Ingrown toenail lifted	0	1
Plaster casts	6	3
Curettage	1	0
Dilatation of cervix	1	0
Exploratory operations	2	1
Removal of adherent pessary	1	0
Excision of two lymph glands from axilla	0	1
Repair of vas deferens	1	0
Skin grafts	0	6
Totals	343	271

Report of Dental Services

From July 1, 1927, to June 30, 1928

Dental examinations	3026
Dental prophylaxis	334
Extractions	4300
Amalgam fillings	97
Cement fillings	180
Gutta percha fillings	96
Temporary fillings	326
Treating teeth	952
Treating gums	1782
Nerves devitalized	0
Artificial dentures made	35
Artificial dentures repaired	57
Plate adjustments	98
Post operative	97
Synthetic porc	80
Process trimming	137
Cysts and granulomas removed	271
Abscesses lanced and treated	47
Gold inlays	63
Gold foil	35
Impressions	115
Impactions	15
X-rays	126
Silver oxide	44
Vincents treated	138
Apicoectomy	1
Curettment	1
Gold crown	1

Laboratory Report for Fiscal Year July 1, 1927, to June 30, 1928

Urinalysis	2991
Blood count (leucocyte)	200
Blood count (differential)	189
Blood smear (malarial parasites)	127
Blood glucose	67
Blood urea nitrogen	15
Wassermann reaction (bloods)	2267
Spinal punctures made and fluids examined for globulin cell count and Wassermann reaction	154
Arsphenamine administered	675
Wassermann reaction for spinal fluids	395
Colloidal gold test on spinal fluid	499
Sputums	67
Tissue sections	6
Examination for Vincent's infection	183
Throat cultures	26
Widals	6
Feces	12
Post-mortems	14
Coagulation tests	14
Red blood counts	25
Basal metabolism	7
Vital capacity	3
Gastric analysis	1
Miscellaneous	50

Physiotherapy Report For Fiscal Year July 1, 1927, to June 30, 1928

Quartz light	290
Leucodescent lamp	85
Diathermy	90

REPORT OF MEDICAL SUPERINTENDENT OF SONOMA STATE HOME

MR. EARL E. JENSEN, *Director,*
State Department of Institutions,
Sacramento, California.

SIR: I have the honor to submit herewith the following biennial report of the Sonoma State Home, covering the period ending June 30, 1928.

At the close of the biennial period, ending June 30, 1928, we had a total enrollment of 3345. The number of admissions during this period were 789, the deaths, discharges and transfers to other institutions being 346. During the two fiscal years 1021 applications for admission were filed. The number of applications on file June 30, 1928, amounted to 822. The net population on this same date was 2260.

The general health of the patients during the past two years has been good and we have been free from any epidemics of contagious diseases.

We are still continuing our sterilization work and during the past biennial period we sterilized 383 patients, an increase over the former biennial period of 87.

In November, 1927, we secured the services of an orthopedic surgeon, Dr. Ethan H. Smith of San Francisco, who has visited the institution several times and operated on our crippled patients, of whom we have quite a number. It is planned that he will do only the most complicated cases and our resident staff will do the less difficult. We are indeed glad to be able to again start on this important work with the physically handicapped children.

In the past two years we have increased our school enrollment from 335 to 507 pupils and very satisfactory results are shown in the training of our female patients in domestic science.

On July 1, 1927, we started a male industrial department under a trained teacher and it is affording splendid training to certain types of patients, as well as effecting a saving to the institution, as they are manufacturing brooms, brushes, fiber furniture, etc. Our capacity in this work is limited, however, on account of lack of space, but as soon as the new employees' cottage, which has been provided for in the budget, is erected we will be able to move the employees now living at Madrona Hall into same and by remodeling that building make an adequate shop for our industrial activities.

During the past year our part-time social worker in the bay cities has been succeeded by a full-time worker, making a total of three full-time social workers on our staff, together with Mrs. Katherine Larimer of Los Angeles, who, although she is employed to look after the cases

of the southern institutions, has nevertheless assisted us to a considerable extent, we paying for whatever expense she incurs while supervising our cases. The number of cases in Los Angeles and its environs has increased to such an extent lately that it is now deemed necessary to have a full-time worker stationed there, and we expect to make such an appointment shortly.

The good accomplished in enlarging our social service department is indeed gratifying, it being estimated that in the past year we saved the state approximately $30,000 by placing patients out on industrial parole. In view of the good accomplished by this system, I recommend that at least three more paid social workers be added to our pay roll for the eighty-first and eighty-second years, their work to be apportioned as follows: one more to work at the institution to assist in supervising the cases north of the bay, one additional for Los Angeles and immediate territory, and one for Fresno or the central part of the state.

On July 1, 1926, we were able to move the male patients living at what was known as Manse Annex to a modern, fireproof cottage which we have called Wagner Cottage. We razed Manse Annex, as it was a temporary frame building erected after the 1906 earthquake.

We have also constructed a cottage at the Poultry ranch, where we have an attendant in charge of twenty boys who are employed in that department.

Over $800 worth of additional playground equipment has been installed during the seventy-eighth and seventy-ninth fiscal years, making our total investment in recreational equipment during the past few years about $5,000. We feel that this is money well spent, as the patients not only derive considerable enjoyment from same but it also is a means of physical exercise for many.

A new modern baseball and athletic field has also been laid out in the left front of the institution.

In addition to the above improvements we have also constructed or improved the following: Addition to state garage, garages constructed at Sonoma Farm, additions to dairy together with installation of new pasteurizer, remodeled two of the largest chicken houses at the Poultry ranch, constructed new brooder houses, incubator cellar and feed rooms, constructed new incinerator at sewage disposal plant, new slop and kitchen refuse disposal unit, constructed new hog farrowing building with twenty-four pens and feed storage capacity, put in new fences on state highway, new road from dairy to poultry ranch, widened several existing roads and constructed retaining walls, cement sidewalks, etc.

As fast as time and labor will permit we are clearing the land at our orchard back of the institution and expect to increase same by about fifteen or twenty acres. Part of this increase is needed on account of tearing out the old cherry orchard in front of the institution in order that we might utilize the space for vegetables and partly on account of the growth of the institution. We have added two acres to our table-grape vineyard and replaced approximately five hundred trees in the orchards.

Our most important needs for the future are: Three cottages for patients, cottage for employees, two cottages for assistant physicians,

improvements to sewers and sewage disposal plant, further development of water system and a commissary and industrial building.

I desire to thank all officers and employees of the institution for their cooperation and faithful service and finally to express to the Department of Institutions, Department of Finance and the Department of Public Works my appreciation for their kindness and great assistance in conducting the affairs of the Institution.

Respectfully submitted.

F. O. Butler,
Medical Superintendent.

REPORT OF MEDICAL SUPERINTENDENT OF PACIFIC COLONY

HON. EARL E. JENSEN, *Director,*
Department of Institutions,
Sacramento, California.

DEAR SIR: Pacific Colony was opened on May 12, 1927, by the admission of 27 inmates from the home in Los Angeles County known as Contenta School. This was followed by the admission of 17 boys from a home school for boys at Sunnycrest on May 23d. From these beginnings our population has increased to 57 boys and 64 girls on June 30, 1928.

The institution was not at that time equipped to provide all the care and training that we would wish, but the need for care for some of these unfortunates seemed to justify the opening of this institution then. Although we have no school building, we have utilized a room intended for a dining room in one of the dormitories as a school room, and we have here given school training to 15 boys and 25 girls this last school year.

We have also given the girls considerable training in sewing, crocheting and fancy-work outside of the necessary work for the institution carried on in the sewing room, all of which helps train the girls for usefulness should they later on be able to go out and earn their own living. I fully believe that the first duty of such an institution as this is to train the boys and girls committed to our care toward a life of usefulness and self-support in the community. Only a part of them can be trained to such a desirable outcome, but we should train all who come into our care, as those who must remain under custodial care are happier and more useful if they have such training.

We have built and completed, from the 1927–28 appropriation, a laundry large enough for our needs for many years to come, and a central kitchen and commissary building. The laundry has been equipped to care for our present needs, and with a little more equipment will be fully able to take care of the laundry for a thousand of population.

The central kitchen and commissary building is in use at this time only at the storeroom, but we have purchased some of the necessary kitchen equipment which we shall install at an early date. Up to the present time we have done the cooking for the boys and girls, and the employees, in the small kitchens provided at the building for serving the food and caring for the dishes.

We now have under construction a building for our employees, who have been living in the buildings provided for inmates, and on the completion of this building we shall have increased room for inmates.

During the past year we have driven a new well, which proved to be a very fine one, providing 122 miner's inches of water on a five-day test. This well is a gravel packed well which taps a bed of gravel over one hundred feet deep and furnishes a very fine quality of water.

We have also completed an underpass under the Union Pacific Railroad, which makes access to the state land south of the railroad, where most of our buildings are located, entirely safe.

We have an appropriation to provide a schoolhouse, gymnasium, and industrial building, and also an appropriation for two more dormitories, plans for which are now being drawn. With these buildings completed we shall have provision for four hundred eighty inmates.

Our farm and dairy have provided us with all the green vegetables and milk that we could use for the entire year, vegetables growing here in the winter as well as in the summer. Our herd of cows has become an accredited herd, having passed the necessary number of tests.

The farm, dairy and vegetable garden, together with the landscape gardening, have furnished pleasant occupation as well as training for our larger boys, and the sewing room, laundry and necessary housework has given a like training for our older girls.

The general health of the inmates has been very good. We have been able, in cooperation with Whittier State School, to have the services of a dentist for the children, and as many of them had had no work done on their teeth before coming to the institution the results of his work have been very gratifying.

On March 15th we secured the services of a woman physician, Dr. Baumbaugh, who has been of the greatest help, not only in looking after the general health of the children, and in making careful physical examination of the girls, but in supervising the activities of the girls especially.

We feel that on the whole we have had a successful year, with substantial progress in the development of this new institution, a work most necessary for the unfortunate child born into the world lacking in the mental equipment necessary to develop into a useful citizen.

The main improvements made by the Department of Public Works, with approximate costs, during the two years are as follows:

Two dormitories, No. 4 and No. 6	$84,791 38
Kitchen and commissary building	78,106 35
Refrigerating plant	4,170 00
Kitchen equipment	1,277 48
Laundry building and equipment	38,104 18
Superintendent's residence and service connection	28,801 78
Boiler plant and building	48,387 68
Boiler plant equipment	17,427 79
Steam service, boiler plant and other buildings	15,519 58
Employees building	23,478 46
Employees garage	2,520 06
Pumping system well	10,250 00
Main sewage system	10,000 00
Bridge	11,785 55
Subway under Union Pacific Railroad	23,127 52
Roads	16,453 64

Respectfully submitted.

GEORGE S. BLISS,
Medical Superintendent.

NOTE.—Dr. George S. Bliss resigned as Medical Superintendent of Pacific Colony, September 1, 1928. Dr. Romney M. Ritchey appointed September 1, 1928.

REPORT OF SUPERINTENDENT OF PRESTON SCHOOL OF INDUSTRY

MR. EARL E. JENSEN,
Director, State Institutions,
Sacramento, California.

DEAR SIR: The report of the Preston School of Industry for the past biennium ending June 30, 1928, is a brief resume of the growth and development of the school during that period. Particular emphasis is placed on the school's program that has been largely the result of this past two years' efforts.

EXPANSION OF THE SCHOOL

The growth and development of the school has not only been in numbers and new construction but also along lines designed to provide a more wholesome atmosphere, better training facilities, and greater opportunities for recreation.

Buildings.

During the year 1927 a cottage having a capacity of 35 boys was completed on what is known as the Riley ranch. This building houses boys employed in vegetable gardening. It is situated on the banks of Sutter Creek, is attractively landscaped, and provides a very pleasant, homelike atmosphere for the boys employed in the vegetable garden unit of the farm department.

A classroom building, hospital and receiving unit, a dormitory building, and a segregation unit for disciplinary cases are now under construction. These buildings will be completed in February, 1929. They will provide added facilities that have been needed for several years and increases the capacity of the school by providing one hundred additional beds. The buildings are class A construction of brick and concrete.

A new boiler has been added to the power and heating plant to care for the additional buildings.

Other construction during the biennium consists of minor alterations and repairs.

Purchase of land.

During the biennium two small pieces of land consisting of seventy-eight acres were purchased. This land is adjacent to the Riley ranch and is deep alluvial soil very valuable for vegetable gardening and growing alfalfa. The increase in population of the School, especially the Mexican population, can be very profitably placed at agricultural work. They not only enjoy the opportunity to work in the various

farm departments of the School but many of them derive valuable training in the kind of work they will follow after release from the School.

Additional training opportunities.

During the biennium a full-time chaplain was added to the staff. His program being a new departure is along with the other religious training activities, briefly outlined in this report. The work of the full-time chaplain is broad in its scope, much of it being nonsectarian in character.

The results of the work have demonstrated the value of the classes and the individual conferences held by the chaplain. Formerly only part-time chaplains were employed.

An evening school for farm boys who work during the day in the various farm departments has proved to be attractive to many of the boys. A statement of its program is given under the school department report. Other evening classes are to be established as soon as facilities are available.

Recreation.

The greatest single factor in creating a more wholesome atmosphere and decreasing the relative amount of disciplinary trouble has been the gradual increase in the facilities for play and recreation.

During the biennium the recreation grounds have been increased in size and a turf football field has been developed. Handball and volley ball courts have been built for each company.

A much greater number of library books and magazines have been provided which affords every boy who desires to read an opportunity to spend his leisure hours reading.

Increase in population.

The increased number of boys the school has been required to receive from the courts of the state the past two years has severely taxed the already overcrowded facilities of the school. During 1926–27 702 boys were admitted, 767 were received during 1927–28, making a total of 1469 for the biennium.

The first year the school's maximum capacity was 575. During the record year the completion of a new cottage increased it to 620.

This large number of boys was cared for only through the early release of 385 boys whose homes were outside of the state and who were returned to their homes under the supervision of the state deportation agent of the Department of Institutions.

Since September 1, 1923, 953 boys have been returned to their parents. The plan of returning nonresident boys to their homes in other states has demonstrated the wisdom of the plan. Very few have returned to the state and caused further trouble. Many of the nonresident boys received by the school have no prior records of delinquency. Their violations of the law are frequently due to economic stress and lack of guidance. The state has not only been relieved of a heavy economic burden in caring for this large number of nonresident youths

but society has been benefited by their return to their former home surroundings and the guidance of relatives and friends.

The number of restless lads that come to the west and particularly to southern California will always be large, but with better facilities in our cities for their reception and care fewer will become delinquent and find their way to the Preston School of Industry.

FUTURE NEEDS

State correctional schools have in the past not received their just proportion of funds expended for the training of youth. The Preston School has not been an exception. It, therefore, needs generous appropriations to properly equip and staff itself for the training of the maladjusted youths that annually are sent to it for correction and training.

The following are some of the outstanding needs of the school:

1. The present water system is inadequate. Additional water for both domestic use and power and irrigation is needed.
2. A gymnasium large enough for recreation, especially during the rainy winter months, would greatly increase the efficiency of the recreation and physical education program.
3. Expanded shop facilities are necessary due to the increase in population of the school.
4. A new site for the dairy should be purchased and a new modern dairy plant erected. Additional dairy stock is needed.
5. A swimming pool for boys should be constructed and the old pool, now too small for the boys, repaired and used for employees.
6. The construction of cottages for employees is a necessity if employees are to be properly housed.
7. An adjustment of the salary schedule enabling the school to compete with public schools in the employment of teachers and trades instructors is essential to the success of the school's training program.
8. The employment of a part-time pyschiatrist to assist in the proper diagnosis of cases reecived by the school is urgently recommended.

LANDSCAPE IMPROVEMENTS

During the past two years much effort has been put forth to improve the grounds of the institution. The natural soil is clay and hardpan which makes it necessary to haul all top soil. Before a tree can be planted a hole must be dug, dynamited and treated. In spite of the difficulties which have to be met, about 1000 trees and shrubs have been set out during the past biennium. A concerted effort has been made to replace natural trees that have died or are dying, with similar trees.

Natural shrubbery such as toyon berry, California wild lilac and manzanita together with nursery stock have been set out. Hundreds of shrubbery cuttings have been started in the hot bed and much has grown sufficiently to plant out.

About 1500 square feet of new lawn have been planted. The lawns are cut as often as is necessary and the cuttings are sent to the poultry yard. An underground sprinkling system was installed before the new lawns were set in. From now on this same system will be installed previous to all new lawn planting.

A rough, unsightly hillside has been planted to hardy shrubs. An adjacent slope has been graded, planted to shrubs and a lawn. To add to the appearance a brick wall was built at the base of the slope. The football field has been planted to lawn. Along the south boundary line of the school grounds for about a mile, eucalyptus trees have been set out.

In March the grounds of the new farm cottage were planted. By continuous care the trees, shrubs, flowers and lawns have made remarkable progress in spite of the fact that many trees are growing in hardpan. A plan for the landscaping of the buildings now under construction has been formulated.

MEDICAL CARE

The medical staff of the school consists of a resident physician and three registered nurses whose schedule is arranged to give twenty-four hour nursing service.

Lack of proper surgical and medical care in the earlier youth of the boys entering Preston necessitates a larger amount of surgery and medical attention than among an average group of young people of the same age.

The hospital services for the past biennium is condensed into the following statistical report:

SURGICAL CASES

	June 30, 1926 to June 30, 1927	*June 30, 1927 to June 30, 1928*	*Total for two years*
1. Major operations:			
Appendectomy	32	44	76
Laparotomy	5	2	7
Herniotomy	10	18	28
Hydrocele	--	1	1
Hemorrhoidectomy	2	2	4
Bone cases			
1. Open reduction of radius	1	1	2
2. Open reduction of clavicle	1	--	8
3. Amputation phalanges	2	6	8
4. Bone graft	--	1	1
Totals	53	75	128
2. Minor operations:			
Tonsillectomy	26	50	76
Ear paracentesis	18	24	42
Peritonsillar abscess	8	20	28
Circumcision	5	1	6
Removal of ingrown toe nail	--	--	--
Totals	57	105	162

Repaired incised wounds, carbuncles, boils, removal of foreign bodies, cellulitis, aspirations of joints and chest. Approximate average per day 5, or 1825 yearly. Total for past two years ending June 30, 1928, is 3650 cases.

CLINIC CASES, SICK LINE

	June 30, 1926 to June 30, 1927	*June 30, 1927 to June 30, 1928*	*Average for two years*
Colds, burns, sprains, minor injuries and treatments:			
Per day	60	70	65
Per week	420	490	455
Per month	1,680	1,960	1,820
Per year	20,160	23,520	21,840

Total for number of cases treated in two years—43,680.

SALVARSAN AND MERCURY TREATMENT

This treatment is given every week to luetic patients.

General average per week	30
General average per month	120
General average per year	1440

PROPHYLACTIC TREATMENT

This treatment is given to all new boys for a period of six weeks.

1. Typhoid vaccine.
2. Smallpox vaccine.
3. Diptheria toxin-antitoxin.
4. Wassermann tests.
5. Physical examinations.

	June 30, 1926 to June 30, 1927	*June 30, 1927 to June 30, 1928*
Daily average	1.95	2.26
Weekly average	13.27	15.88
Monthly average	57.5	68.83
Yearly	690.	826.

BED PATIENTS IN HOSPITAL

	June 30, 1926 to June 30, 1927	*June 30, 1927 to June 30, 1928*
Daily average	27	30
Weekly average	189	210
Monthly average	756	840
Yearly average	9,072	10,080

DENTAL CARE

Since January 1, 1928, a full time dentist has been employed. Prior to that time the dental work was done on a piece basis. The amount of work necessary to put boys' teeth in good condition is unduly large inasmuch as may of the boys are from broken homes or from homes where the finances did not permit proper dental care.

The following is a report of the dental work done by the resident dentist from January 1 to June 30, 1928:

Number of boys operated on	479
Number of silver fillings	769
Number of porcelain fillings	177
Number of cement fillings	91
Number of treatments (teeth)	109
Number of extractions	267
Number of cleaning and scaling	354
Number of plates	2
Number of crowns	6
Number of bridges (5 new; 4 repaired)	9
Number of pyorrhea and gingivitis treatments	36*

*Cases.

CLASSROOM PROGRAM

Organization.

The problem of delinquency is closely linked with that of inefficiency. Many boys are deficient in the academic training necessary to become successful tradesmen. It is the purpose of the school department as much as possible to overcome this deficiency. To this end, only those subjects are offered which will be of practical value in daily living, or which apply directly to the trades in which instruction is being given.

For classification, the school is divided into six groups: The receiving school; the intermediate group; the junior high school group; the senior high school group; the commercial class.

Diagnostic work.

An effort is being made to test the mental ability and academic training of each boy entering the school, and to determine his indi-

vidual aptitudes. This department of the school is being enlarged so that its scope will be greatly increased during the coming biennium.

Americanization.

The foreign population of the school is largely Mexican. Many of these boys are native-born American citizens, yet so slow is the process of assimilation that little or no knowledge of English has been acquired. This department attempts to inculcate good citizenship through a proper knowledge and appreciation of our national institutions. Reading, writing and spelling are emphasized.

Mexican boys are, for the most part, anxious to learn and are very appreciative of the efforts being made for them.

The teaching of illiterates.

Many boys received in the Preston School are retarded, either because of low mentality or loss of school opportunities, and a small number are entirely illiterate. These boys will be day laborers; but they can be taught what constitutes a decent scale of living and how to work efficiently, save money, and maintain a comfortable home life. They are taught to read and understand the current periodicals, to write ordinary business letters, and to handle figures well enough to take care of their own business affairs.

The intermediate department.

The largest number of boys in the school classify in grades fifth to seventh. Here is the point in public schools where the school program either becomes too difficult or proves uninteresting to certain types of boys. They drop out of school or become truants. Because of the school attendance laws employment is not ordinarily granted to boys of compulsory school age, unless special arrangements are made. Many of the boys of the type received by the Preston School of Industry are neither interested in school or apprenticeship training. They become idlers, and drift about the city or from one city to another. Their delinquency is therefore not surprising.

These boys are naturally no more interested after their arrival at a state school than they were in the public school. Extraordinary efforts are made to arouse their interest. Effort is made to correlate the classroom work with their occupational activities. The classroom work of this group therefore varies widely from the conventional fifth, sixth, and seventh grade work of the regular public school program.

The junior and senior high school groups.

Many of the boys in this group realize their educational deficiencies, and pursue high school subjects with a view to returning to school upon their release from Preston. Here, as in other classes, the work is suited to individual needs and correlated as far as possible with the boy's trade. High school credits may be earned.

The commercial class.

This class gives business training to boys of high school grade. Bookkeeping and stenography are offered in addition to business English

and spelling. The class training is supplemented, wherever possible, by office practice in the administrative offices of the institution. Office work ranks as a trade in the vocational program, and a number of boys every year enter upon this type of work when released from the school.

The machine shop class.

A selective group from the other schools is assembled for study preliminary to machine shop practice. Here a close study of the boy's aptitude for mechanics is made, and boys unsuited to the work are eliminated. This preliminary class offers instruction in the rudiments of machines, the phraseology of the machine shop, and laboratory work preparatory to actual machine shop practice.

Evening classes.

The night school is conducted for the benefit of the farm boys who are working during the day in the various farm departments. The subjects taught are correlated with the work. For example, in mathematics, if a boy is in the dairy and has completed the fundamentals, he is given dairy problems. In teaching fundamentals, all except drill problems, relate to the farm.

In teaching English, use is made of farm periodicals, bulletins and correspondence courses. Boys wishing to take correspondence lessons are permitted to do so provided they have advanced sufficiently to be able to profit by them. The University of California has mailed them gratis to those unable to pay for them. Lessons in science are occasionally given and the compound microscope used.

Sometimes a Mexican boy is transferred to the farm who has never been to school. In that case he must be taught to read and write in the evening school. When further advanced a simple book on farm subjects is substituted for the regular textbook.

It is possible to expand the evening courses to include a class in Americanization, one for vegetable gardening, one for dairying and one for the other farm subjects. Night study is almost a necessity for farm boys since the nature of their work is such as to keep them busy during the day. And there is no greater opportunity to help these boys than by teaching them the technical aspects of their vocation at the same time they are gaining the practical experience in the field.

It is important, however, to find teachers who understand farm problems and who are qualified to teach the fundamentals as well as the vocational subjects.

Journalism class.

The monthly cadet publication of the school was for some time without satisfactory leadership due to the fact that the staff members who would be the logical sponsors for it were unable to add it to their already crowded programs. The work was finally assigned to the resident chaplain.

The organization for its production was revised and now stands as follows. Voluntary classes from both morning and afternoon schools meet once a week with the chaplain for the twofold purpose of making general elementary studies in the field of journalism and also of doing

part of the actual work of preparing the local paper itself. From these classes a group of three are selected who seem by their interest and qualifications to be best fitted to serve as an editorial board. Again, one of this number is selected and given a definite assignment to the chaplain's office, where he spends at least one-half his time interviewing, reworking reports, and setting-up the Review. The art work of the paper is being given special emphasis and cuts are made each month from sketches by boys in the school. As soon as facilities are available, two-color work and other improvements will also be added.

The aim of The Preston Review was expressed recently by the superintendent as being not only to "give the news events of the school community but also to reflect the thought and opinions of the cadet student body."

Mechanical drawing class.

Because of the fact that the institution offers no other work in pure art or design, the scope of this mechanical drawing class is considerably broader than a strict interpretation of the term would imply. The aim, furthermore, is not merely to supply the boy with a certain amount of abstract knowledge in the field, but so far as conditions permit, to adapt instruction to the line of future activity to which each boy is looking forward. Each new member of the class is questioned regarding his intended vocation and his program planned accordingly. A survey of the group at one time for example shows boys with the following major interests: plumbing, sheet-metal work, woodwork, electrical work, commercial art, radio, aviation, landscape gardening, and cartooning.

The number for which accommodations can be provided is about eighteen and the group enrollment usually stands at about its maximum possibility. The average time actually spent by each member of the class is about two hours each school day, and the average enrollment period is about five months, making a total of approximately 250 class-hours per person.

Like other school work in Preston School, especial ability is recognized; where it appears, the boys are given the regular high school course which covers material in Books One and Two of the Ermeling-Fisher-Greene series. The final accomplishment is also of course affected by the fact that about one-third of the boys have had previous training along the same line.

An indication of the results achieved appears in the annual exhibit made at the California State Fair; in the last such exhibit, five blue ribbons were awarded in the high school class A group. Further results, not thus measurable, lie in the added ability and efficiency of the various boys in their selected lines of vocational activity.

Plans for Future Development.

The school department has been handicapped by lack of equipment and proper classrooms. This difficulty will be removed upon the completion of a fine new modern school building now under construction, and a decided improvement and impetus to the academic work of the school is expected. The statistical and diagnostic program will be

enlarged, with a resultant increase in the efficiency of correlation of the academic instruction to trade instruction and to individual needs.

VOCATIONAL TRAINING

The modern correctional school, to function properly, must apportion a major place in its program to vocational training. In Preston, responsibility for the proper placement of boys in trades rests upon the trades council, which consists of the superintendent, the assistant superintendent, the detail officer and the school principal.

Shortly after each boy enters, definite information is obtained concerning his past schooling, mental status, personal habits, family connections and work record. With this as a basis, the trades council outlines his program and places his name upon an eligible list for some trade. In doing so, the following points are carefully considered:

1. What is his real ambition?
2. What kind of work will he have an opportunity to follow when he leaves Preston?
3. What are his qualifications as judged by:
   (a) Previous experience.
   (b) General intelligence.
   (c) Stability of character.
   (d) Physical ability.

The ideal program is a half day in school and a half day in a suitable trade until such time as a boy becomes sufficiently advanced in his trade to warrant assigning him there all day. If he is found to be a misfit in one trade, he is transferred to another. Frequently a boy who will not qualify in the machine shop or in a buildings trade as a mechanic can learn to be a butcher, or a baker, or a laundryman. Precaution must be taken, however, to see that no changes are made unless he can derive some advantage therefrom, as many are restless and unstable and will not stick with their work unless compelled to do so.

The machine shop is an example of a training school organized to take care of instruction as well as production work. A well trained vocational instructor conducts a morning class of from 12 to 16 beginners. After an hour of study in the classroom the boys are given practice work covering the gas engine, its care and repair, and the boy of average ability is ready for floor work in the shop where he can do real production work which can stand the test of actual use. Under a competent maintenance man he receives the practical experience which is to be his means of earning a livelihood when discharged from the school.

Real growth in vocational training can be assured by the use of modern equipment, enlarged facilities to take care of the normal increase in population and lastly by highly-trained, certificated tradesmen. The salaries of tradesmen should be commensurate with those received by vocational teachers in our secondary schools. Provision should be made for additional training from time to time and adequate supervision should be given in order that higher standards may be obtained. Too often men are kept in state service who show no inclination or are given no opportunity to keep up with the developments rapidly taking place in all occupations today.

In addition to their trade knowledge and their ability to teach, it requires men of patience and sympathy and understanding to be of real service in a correctional school. It is not too much to say that all progress in our institutions depend largely upon the caliber of the men who daily contact the boys, for they set the standards which the youth imitate.

PHYSICAL EDUCATION

The employment of a full-time physical and athletic director in a correctional institution like Preston School was the mark of a changing emphasis in the program of such an institution. The major significance of that changing aim was the discarding of the thought of such periods of confinement as the school represents, as merely so many months of detention and punishment. The psychological value of "play" has not only become recognized theoretically but has been attested through numerous channels, as for example the playground movement. Nature seems to require an outlet for a certain amount of energy in the adolescent period; whether that energy is used in clean play under competent supervision or predatory and precriminal activity avoiding supervision, is more and more recognized as a tremendous factor in the future of the boy.

Because of the nature of the situation it is possibly true that it is with less difficulty that the athletic program of Preston School has fallen into line with the growing emphasis in the scientific-athletic field, which is that such training must be for the larger number even if less intensive, rather than for a selected few who are endowed with unusual prowess along some particular line. With this in view the attempt through the past biennium has been to reach and actively interest an increasingly large number of the cadets. Despite the handicap due to the lack of inside gymnasium facilities, this has been materially accomplished. The opportunity provided by physical education to learn to act wisely and honestly in situations which are physically wholesome, mentally stimulating and satisfying, and socially sound, has thus become an increasingly large factor in the institution's life.

The institutional organization into companies furnishes the natural basis for intramural sports. Leagues have been organized and run in the following sports: Football, speedball, indoor baseball, basketball, horseshoes, track events, and swimming. The large "state" companies (which have as many as seventy-five members in some instances) have had two organized teams, while the smaller "cottage" companies have had one each. Each company team in such leagues plays at least twice each week, thus affording a maximum opportunity to the largest possible number of different boys. Never before in the history of the school has such a large number of cadets participated in these sports as during the past two years.

From the best material revealed by the company teams is selected the "representative team." This usually consists of from forty to sixty boys representing all cottages and companies. This group not only furnishes a group of assistant coaches who assist in the direction of their own local teams, but also supplies the group which engages in outside competition. This latter team competes with various institutions including high schools, state teachers colleges, junior colleges, and the

University Farm School. During the past biennium it has been successful in winning a majority of these extramural games.

To those cadets who have participated in three-fourths of the games played by the representative team in any one sport, the school awards "Block P" letters. These letters were first given in 1926 and since that time 55 boys have won them in the three major sports—football, basketball, and baseball. Even greater rivalry and interest is shown in the daily games of the intramural leagues, however, since the winning team is given a cup and a dinner in the superintendent's apartments.

Extensive improvements in the outdoor equipment have been made. The baseball diamond has been moved and the athletic field leveled to give a satisfactory surface. Handball courts and basketball courts have been erected in every company's section of the grounds. Special care has been taken to see that each company was continually supplied with usable athletic material. The swimming schedule has been arranged to offer the largest opportunity to the most boys with special periods for those whose trade requirements prevent them from going in with their regular company groups.

The major holidays have been used at least in part for carefully planned track and swimming meets. Each company has been allowed to submit an equal number of contestants. Cash prizes and other recognitions have been given both for the high-point men and the high-point companies.

MUSIC

Music in Preston School occupies the unusual position of being both vocation and avocation. Obviously it is a field in which a boy's natural talent and aptitude must be given first consideration. But it is also a field of extremely practical vocational significance for the boy who has the taste, persistence, and will. So it is necessary to avoid the danger of overstressing what may be only an intermittent recreational item in the boy's future since the boy in Preston is at an age when lifework is already a pressing and immediate problem and at the same time conserve the morale value and the "trade" possibilities.

Each new entrant is questioned regarding his interest and desires in the musical field; and no small number appear who profess a perhaps long-repressed desire in this connection. The assignment to the musical work is handled as any other school or trade assignment, through the action of the trades council. The necessities of the institutional program make it impossible to offer training in other than brass, woodwind, and percussion instruments. But boys who have had previous training in string work, find a place in the school orchestra as will be presently indicated.

A full-time musical director is employed for the work. The band is handled in two divisions. The "second band" is a euphemism for the group who are starting out in the work. One-half the working day during five days per week is set aside for this. Of necessity the work and instruction are individual, and this group never professes to attain to group-playing. Upon the accomplishment in satisfactory fashion of a definite number of lessons, the student is promoted to the "first band." He now comes into the field of direct group-training and

public presentation. This section practices for a period of one and one-half hours on five evenings per week, and also adds drill formation practice on one-half day each week. Thus it may be seen that after the preliminary period the musical work no longer interferes with the school or trades program of the boy.

The first band, which averages between forty and fifty members, does not limit its activity to the school itself, where it plays for military drills, Sunday morning assemblies, and special events. It is subject to invitation to play concerts and accompaniments in the local village; it makes a number of trips per year to more distant points for the laying of cornerstones, holiday celebrations such as the Asparagus Festival at Isleton, etc. Its crowning achievement, however, is its annual invitation by the State Agricultural Society at the State Fair in Sacramento.

The school orchestra is composed of from eight to twelve instruments selected from the band group, with the addition of such string instruments as may be available. It has regular practice periods which total about five hours per week. In addition to a regular playing assignment at one of the Sunday religious services, it plays for officers' entertainments and for various programs of both secular and sacred character in the village of Ione. The school employs a part-time pianist to accompany the orchestra and play at the Sunday assemblies, etc.

Cadets who have ability in vocal work are given the opportunity to gain experience in group-singing through a cadets' chorus which practices twice a week and sings at the Sunday assemblies. This is under the joint direction of one of the school officers and the school accompanist. It is hoped to increase and improve the opportunities for training in the vocal field, continuing as at present on a voluntary basis which does not interfere with the boy's trade and school activities.

Boys who thus enter the school with no knowledge of music or of musical instruments, while not trained into first-class professionals in the few months available for such training, are given either a basic understanding, or at least are given a sound and worthwhile avocation.

MILITARY DRILL

Preston is not primarily a military school. However, the administration of the school recognizes the value of close order drill in securing good discipline, as it develops instantaneous and willing obedience to orders.

The receiving program has therefore been arranged so that each boy is required to attend military school one-half day, where he studies and recites for about two hours, after which he marches to the field for two hours of practical drill. For this purpose extracts from "Basic Military Training" of the R. O. T. C. are printed in small booklet form.

This course is completed in about thirty days, or in the period of time that the boy is in the receiving company. Thereafter, all boys drill only ten minutes per day.

The first lesson consists of committing to memory the "Position of the Soldier," or "Attention," and being able to recite the same while standing in that position. This is a valuable beginning, since the boy's troubles have more or less distracted his mind and scattered his thoughts.

When taught to concentrate in this manner he is able to better apply himself to work in his trade.

Furthermore, close order drill teaches team work and unity. The boy learns to cooperate with his fellow cadets and if qualifications of leadership are present there is ample opportunity to develop them by becoming a cadet officer. Such a boy usually becomes a leader in other activities and a foreman in his trade.

On Saturday mornings, cadet officers' school is held. This school is attended by the cadet major, the captain and lieutenant of each company. These officers are taught the necessary qualifications for good drill instructors. They study physical training and practice the proper exercise of the voice in giving commands.

On Sunday mornings before marching to chapel, the battalion is formed for dress parade. While passing in review, competent judges decide which companies have the best lines, naming first, second, and third places. There is much enthusiasm, and competition is keen for the honor of first place, which is announced after the parade.

A quarterly military competition is held. Each company drills in movements specified by the judges. The prize to the winning company is 100 credits to each boy in the company toward his parole. A second prize of 50 credits is awarded. This competition with its prize features has stimulated interest in military work.

RELIGIOUS AND MORAL TRAINING

The Preston School recognizes that its obligation to the boys and young men placed in its care is not fulfilled even with the furnishing of food and clothes, vocational training and placement, supervised recreation, etc. These things may all be ineffective without the stabilizing effect of moral and religious training. In view of the fact that behind so much juvenile delinquency is the problem of emotional instability, the technique of religious training in an institution such as Preston must be very largely developed on and around such elements as can function to bring about an increased stability in emotional reactions. In other words, a religious influence which merely increases emotionalism can hardly be effective; a careful program of rational upbuilding along the lines of basic religious ideals and activities is needed. As yet our standards for social and religious measurement and diagnosis are only in their infancy. The problem, however, is fully developed and we must meet it as best we can without waiting.

A considerable percentage of those committed to the Preston School come from a background of religious influence. More than one-third are from Catholic families; less than 3 per cent are Jewish, another 3 per cent profess Christian Science; 2 per cent are Mormon; about 3 per cent refuse to acknowledge any religious connection whatever; and the rest are nominally Protestant.

The school has no resident social worker other than the Protestant chaplain. For this reason one section of his work is of general and interreligious character. Each new entrant is interviewed for the purpose of learning his religious background and affiliation, as well as any personal or family problem which solution may be essential to the

boy's proper readjustment. During his first six weeks of preliminary segregation, the cadet is given four talks on problems of social and personal hygiene with ample opportunity to ask questions. During his first ten days he also attends an adjustment class an hour, in which is explained to him the details of the organization and operation of the institution, again with opportunity for having answered the many questions which perplex the cadet at this time.

After this period it is largely voluntary with the cadet whether or not he passes out of the chaplain's influence. In cases of notification of death or of serious emergency, the resident chaplain will again serve to soften the blow and render whatever service is possible. Besides this on midweek evenings at numerous times during the year the chaplain conducts six-weeks discussion classes, dealing with such nonsectarian subjects as "personal ethics," "social adjustment," "home building," etc.

From a sectarian point of view, the work is divided as follows:

1. *Protestant.* Since the coming to the school of the present Protestant chaplain, the aim of "The Christian Training and Service Department" has been first to conserve and expand any active religious influence which has been established in the boy's life previous to his coming to the school; second, so far as is possible in the time and under the conditions of the school life, to make practical, effective and vital any nominal religious influence or tendency which may be present in the boy's life; third, to seek to present to those boys who have not previously had any religious interest, the effective principles of the teaching of Christ; and fourth, in the case of any boy reached in any of these divisions, to strive to build a substantial basis of underlying Christian ethical and spiritual conviction which shall be truly effective in aiding the boy in his general social adjustment.

The work may be divided into three streams of activity—general, continuation, and intensive, which correspond only in part with the threefold statement of purpose indicated above.

The general intent of the department is to keep in operation throughout the entire year a continuous "institute" in which the boy may secure the type of religious training best suited to his needs and may make the most profitable use of the time he is in the school, whether it is the entire fourteen months or a shorter period. To this is added some extension work especially through the earlier months of the parole period. Steps have also been taken to organize through the state groups of Christian business men who will take a personal interest in the Protestant boys who may be released to their respective communities and will act as advisors and sponsors in matters of home adjustment and religious and social contacts.

The continued contribution by the United Church Brotherhood of Los Angeles County of a part of the salary of the Protestant chaplain deserves especial mention. The Social Service Committee of this organization has also taken an active part in the extension work just mentioned, under the leadership of its late chairman, Mr. Frank Ballinger.

2. *Catholic.* A part-time chaplain is employed, and he holds mass each Sunday morning. This service is also attended by the local Cath-

olic constituency, both employees of the institution and people from the village and neighborhood of Ione. The effectiveness of this service has been increased by the improvement of the music, and it is regularly attended by a considerable portion of the Catholic boys in the school. Confessions and communion are held from time to time and as occasion makes advisable catechism and instruction classes are conducted.

Catholic literature is regularly received and made available to the boys, and occasional visits to the institution are made by Catholic religious welfare workers.

A Catholic committee composed of three employees of the school also assists in promoting the religious work among the Catholic cadets.

3. *Jewish.* The Jewish population of the school is small, being always less than 3 per cent of the total. As this does not justify a special worker, the sponsorship of the Jewish boys has been assumed by the Protestant chaplain.

This group now has a regular Sabbath evening meeting at which scripture and prayers are read by the members, and religious and intellectual studies and discussions carried on. The group is organized under the name of The Junior Big Brothers. The holidays are observed with the aid of members of the Jewish faith from Stockton or Sacramento and careful provision is made by the institution for fasting and other special arrangements which these days require.

Members of the Jewish Committee for Personal Service visit the school frequently and hold conferences with the boys; this committee also keeps the boys supplied with prayerbooks, scriptures, and the Jewish Daily Bulletin.

4. *Christian Science.* The Christian Science churches of northern California join in maintaining a part-time field worker at the school. He conducts regular Sunday morning classes for boys interested, and maintains a religious service both for the boys and for members of the staff and residents of the community who wish to attend. Special instruction classes are conducted on Friday evenings.

The Christian Science Monitor and other religious literature is provided each week for the boys who desire it.

PAROLE

During the last two years it has been the endeavor of the Parole Department to emphasize the work where the best results may be obtained. Chief in importance is the better training of all boys in their responsibilities and obligations which must be assumed upon entering the outside world. This is accomplished in a parole training class which meets in the evenings just prior to the time when they are ready to come before the parole commissioners for their final hearing. The instructions are given by the chief parole officer and include subjects covering their future responsibilities and obligations.

First: They are instructed how to make out their monthly report and the importance of having these reports neatly written and mailed on time the first of each month. They sign an agreement that they will properly fill out and mail their reports regularly the first of each month until they receive their legal discharge, using pen and ink and writing as neatly as they can.

Second: Knowing that the future success of the boys depends upon the way they do their work, special emphasis is placed upon their responsibilities to their employers, how to develop their abilities for promotion and better service. They agree to use their best energies in whatever employment they may have and earn a reputation for honesty, reliability and for being a good worker. They are also instructed in how to secure employment when out of work by following the instructions given in a booklet prepared for that purpose: how to secure an interview and explain their abilities and qualifications for the position they are applying for. They are also instructed to keep a record of each interview held and arrange at least ten interviews a day until they secure a position.

Third: In regard to finances, full explanation is made in the class covering different kinds of investment, life insurance and savings. Special emphasis is placed upon the importance of regular and systematic savings, and the building and loan and savings bank plans are fully outlined and described. They agree to keep out of debt, pay all expenses, board and room rent and other bills promptly and save as much money as they can from their earnings regularly.

Fourth: Realizing that the future happiness of every young man depends very largely upon the way they conduct themselves in their homes and in their social and business relations, all phases of their conduct are gone into as thoroughly as possible. A great many boys and young men get in trouble because they are misunderstood in their homes and school. A large percentage of the boys in the Preston School began getting into trouble through misunderstandings in school and disobedience at home. Before leaving the class they have full understanding of how they will be able to correct these difficulties and keep from having such misunderstandings in the future, if they will follow the teachings given. They agree to so conduct themselves in their homes that there will be no cause for complaint or nagging about staying out late nights, bad association, spending their money foolishly, or for any other reason.

Fifth: All the boys in the class seem to be ambitious and anxious to keep out of trouble in the future; and definite instructions are given how to become interested in social activities, recreational and educational studies along the line of their employment and chief interests; companionships and associations which will tend to keep them away from evil influences in whatever environment they may have to live; the value of developing clean habits and good surroundings, and where to find the proper recreational advantages are specially stressed. Before leaving the class each one passes an examination and writes out on paper a full description of all the responsibilities and obligations he will be called upon to assume, so we will know he has a thorough understanding in regard to these matters and under the head of "Keeping out of Trouble" they agree not to associate with any boys who have been in the Preston School or in trouble before; stay away from public dance halls, pool halls, prize fights and other questionable places of resort; leave automobiles, narcotics, liquor and gambling entirely alone; uphold law and order and protect the rights and property of other people as a good citizen should.

After the boys have completed this parole training class they come before the parole commissioners' meeting and for examination as to their understanding and knowledge of their responsibilities and obligations and instruction regarding employment. Two or three months preceding the date of this parole meeting arrangements have been under way by the parole officers in the field for supervision and employment. It is the policy to have all arrangements for employment and supervision completed so that instructions may be given to each boy in the parole commissioners' meeting where he will report for work when he arrives at home. After he understands fully what these responsibilities and obligations are he signs his parole contract in the presence of the parole commissioners. All boys who are passed for parole at this meeting are invited to be present at a dinner, given in the superintendent's quarters, where each boy will be prepared to make a talk, explaining what he has accomplished in the Preston School and his plans for the future. The boys respond splendidly in these talks, and although it is a hard task for them they seem to enjoy the meeting.

After a boy is released the parole officer will call on him as soon as possible after he arrives at home to see if he is making proper adjustment and to help solve any misunderstandings, disagreements or problems that may arise, realizing that the most critical period in the boy's life comes when he leaves the school and begins his readjustment in the outside world.

In the last biennial report a request was made for additional help in the parole supervision and since then two parole officers and a part-time stenographer for the parole office have been added. We now have a parole officer for San Francisco and the bay district, one for the city of Los Angeles, and another in the scattered territory outside of Los Angeles. The chief parole officer devotes more time to the training of boys and interviews with them at the school and general supervision of the parole work. Better results are being obtained since this arrangement has been made, in spite of the fact that more boys are being taken over by the parole department and employment conditions have been unsatisfactory.

The following study of parole activities will be of interest, showing where the boys on parole are located at the beginning of the next biennial period, July 1, 1928, and where the greatest need for supervision is evident:

Summary of Boys on Parole June 30, 1928

County	*Doing well*	*Average*	*Negligent*	*Failure*	*Total*
Alameda	19	17	7	2	45
Colusa	--	2	1	--	3
Fresno	10	10	2	2	24
Glenn	1	--	1	--	2
Humboldt	1	2	1	--	4
Imperial	1	1	4	1	7
Kern	--	2	--	--	2
Kings	2	2	--	--	4
Los Angeles City	44	73	60	25	202
Los Angeles County	22	40	33	6	101
Madera	1	2	--	--	3
Marin	--	2	1	--	3
Mendocino	1	--	--	--	1
Merced	1	--	--	--	1
Modoc	--	1	--	--	1
Monterey	3	1	--	--	4
Napa	--	--	1	--	1
Orange	3	6	3	--	12
Placer	1	--	1	--	2

County	*Doing well*	*Average*	*Negligent*	*Failure*	*Total*
Riverside	4	11	4	--	19
Sacramento	6	2	2	2	12
Shasta	1	3	--	--	4
San Benito	1	--	--	--	1
San Bernardino	6	10	5	--	21
San Francisco	8	18	8	--	34
San Luis Obispo	--	1	--	--	1
San Mateo	3	2	--	--	5
Santa Barbara	4	4	--	1	9
Santa Clara	1	7	2	2	12
Santa Cruz	1	1	--	--	2
San Diego	9	7	3	--	19
San Joaquin	3	6	--	1	10
Solano	--	1	--	1	2
Sonoma	2	2	1	--	5
Stanislaus	3	1	--	--	4
Sutter	1	2	--	--	3
Tulare	--	1	2	--	3
Ventura	1	3	--	1	5
Yuba	2	2	--	1	5
Totals	166	245	142	45	598

The chief causes for violation of parole are broken homes or misunderstandings at home, unemployment and undesirable companions. The parole officers are instructed to conduct their interview with the boy in the home when members of the family are present, and special interview books and blanks are used which correlate the parole training class with the information desired. A careful checkup is made in asking the boy and his parents questions regarding his conduct, employment, what he is doing with his earnings, etc.

Reports

20—On time; satisfactory.
15—For sending report late.
10—Reported when notified.
5—Negligent; not interested.
0—Reports only when personally interviewed.

Employment

20—Regular, promotional, satisfactory.
15—Irregular or dissatisfied.
10—Odd jobs and labor.
5—Changeable; unsatisfactory; discharged.
0—Refuses work; shiftless; wanderlust.

Savings and Investments

20—Regular and systematic.
15—Occasional; then withdraws.
10—Spends lavishly; selfishly; foolishly.
5—Buys motorcycle; cut down auto.
0—Earns little; in debt; dishonest.

General Conduct

20—Satisfactory, habits good; neat.
15—Smokes cigarettes; careless.
10—Out late nights; restless; disobedient.
5—Disagreeable at home; argues.
0—Deceives; falsifies; profane.

Keeping out of Trouble

20—No complaint of any kind.
15—Bad associates.
10—Pool halls, public dances; resorts.
5—Gambling; drinking; disorderly.
0—Petty stealing; forgery; arrest.

per cent.

After the training class checkup is completed the following test of the boy's attitude, temperament and disposition is made:

Attitude:	*Temperament:*	*Disposition:*
Willing	Ambitious	Agreeable
Obedient	Enthusiastic	Goodnatured
Disobedient	Visionary	Obliging
Argues	Listless	Disagreeable
Obstinate	Moody	Bad temper
Exaggerates	Restless	Egotistical
Headstrong	Selfish	Spiteful

A further check is made to determine the boy's standing and progress, whether he is above average or below, under the following headings:

	CHECK ESTIMATE IN COLUMN				
	Superior	Above Average	Average	Below Average	Inferior
Intelligence					
Sense of responsibility					
Trustworthiness					
Adaptability					
Stick-to-itiveness					
Progress					

The parole officer in the field is instructed to make a complete report to the parole office covering each interview held in this manner. Where it is impossible to obtain an interview in the boy's home, a statement is made of the facts obtainable and the reason given why the interview can not be held in the home. A report is made to the Superintendent and Department of Institutions each month for every boy on parole, under the following heads:

(a) HONOR ROLL, boys who are doing well.
(b) AVERAGE, boys who need more or less supervision and coaching, but who are sending the reports and making an average response.
(c) NEGLIGENT AND DELINQUENT, boys who have not made their reports for one or more months and who need careful supervision and follow-up in order to get them in line. This is the group requiring the greatest amount of attention and supervision on the part of the parole officers in the field. Some of these boys have left home, or their parents have moved without leaving a forwarding address and it takes a great deal of time to locate them and get the information required. The parole officers are instructed to spend as much time as necessary to get the boy settled and back on the honor roll as soon as possible.
(d) THE FAILURES, boys who are charged with new offenses, run away from home or get in trouble. An investigation is made when boys are arrested and the parole officer is instructed to see that they have a proper hearing and a square deal and we cooperate fully with the court and other authorities in making whatever disposition of each case which seems most advisable.

The following summary of the boys who have been in trouble during the last two years is given, and offers an interesting study of our parole field and where the greatest need for better supervision is evident:

Summary of Arrests and Commitments from July 1, 1938, to June 30, 1939

County	July 1, 1938, to June 30, 1937 Sentenced to prison	Returned to Preston School	Total	July 1, 1937, to June 30, 1938 Sentenced to prison	Returned to Preston School	Total
Alameda	0	7	8	0	6	11
Colusa				1		1
Fresno	1	1	2	1	3	4
Humboldt					2	2
Imperial	1		1			
Kern	1		1			
Kings		1	1		2	2
Los Angeles	26	22	48	30	20	50
Merced	1		1			
Monterey		1	1	1		1
Orange	1	1	2	1	1	2
Placer					1	1
Riverside					1	1
Sacramento	0	3	3			
San Bernardino				3	2	5
San Diego		2	2			
San Francisco	1	5	6	3	7	10
San Joaquin		1	1		1	1
Santa Clara	1	1	2		1	1
Stanislaus					1	1
Sutter		1	1			
Tulare		0	0			
Ventura	1		1	1		1
Yolo		1	1		2	2
Total	15	46	61	48	51	99

CONCLUSION

The above report has been compiled through the assistance of members of the various school departments. The report, like the school program, is the combined expression and efforts of several people.

The past biennium, because of an increase in population and an expansion of the school program, has been one of hard work for the members of the school staff. It has, however, been a period of harmonious activity and steady progress.

Sincere appreciation is expressed to members of the staff for their untiring labors, their loyalty, and devotion to the cause.

Respectfully submitted

O. H. Close,
Superintendent

STATISTICAL TABLES—PRESTON SCHOOL OF INDUSTRY

TABLE No. 1

Inventory Statement

	[illegible]	[illegible]
Admitted by transfer	[illegible]	[illegible]
Admitted on parole	[illegible]	[illegible]
Admitted on discharged	[illegible]	[illegible]
Escapees at large	[illegible]	[illegible]
Totals	[illegible]	[illegible]
Added to roll during year—		
New commitments	[illegible]	[illegible]
Readmitted from Whittier State School	[illegible]	[illegible]
Readmitted from absconders	[illegible]	[illegible]
Returned from deportation	[illegible]	[illegible]
Totals	[illegible]	[illegible]
Total movement during year	[illegible]	[illegible]
Removed from roll during year—		
Discharged from institution	[illegible]	[illegible]
Discharged from parole	[illegible]	[illegible]
Released on order of court	[illegible]	[illegible]
Escaped at large or from	[illegible]	[illegible]
Transferred to parole	[illegible]	[illegible]
Transferred from discharged	[illegible]	[illegible]
Transferred from escapees	[illegible]	[illegible]
Died in institution	[illegible]	[illegible]
Executed by court	[illegible]	[illegible]
Transferred to absconders from discharged	[illegible]	[illegible]
Transferred to absconders from escapees	[illegible]	[illegible]
Transferred to absconders from parole	[illegible]	[illegible]
Deported	[illegible]	[illegible]
Total removed for	[illegible]	[illegible]
Total population at end of year	[illegible]	[illegible]

TABLE No. 2

Statement of Actual Population in Institution

	[illegible]	[illegible]
In institution at midnight	[illegible]	[illegible]
Received during year—		
On new commitments	[illegible]	[illegible]
On recommitments from parole	[illegible]	[illegible]
On return from parole	[illegible]	[illegible]
On return from furlough	[illegible]	[illegible]
On return from escape	[illegible]	[illegible]
On transfer from Whittier State School	[illegible]	[illegible]
On return from deportation	[illegible]	[illegible]
On recommitment from deportation	[illegible]	[illegible]
On recommitment from furlough	[illegible]	[illegible]
Total received	[illegible]	[illegible]
In institution during year	[illegible]	[illegible]
Passed out during year—		
On discharge	[illegible]	[illegible]
On order of court	[illegible]	[illegible]
On parole	[illegible]	[illegible]
On furlough	[illegible]	[illegible]
On return to court	[illegible]	[illegible]
On escape	[illegible]	[illegible]
On death	[illegible]	[illegible]
On deportation	[illegible]	[illegible]
On transfer to Whittier State School	[illegible]	[illegible]
On transfer to Stockton State Hospital	[illegible]	[illegible]
On transfer to Sonoma State Home	[illegible]	[illegible]
Total passed out	[illegible]	[illegible]
Total population at end of year	[illegible]	[illegible]

TABLE No. 3

Statement of Paroles

	June 30, 1926	*June 30, 1927*
On parole at midnight	470	601
Paroled during year	351	400
Paroled from furlough	101	8
Totals	922	1009
Discharged from parole	179	233
Term expired on parole	68	62
Returned from parole	25	42
Recommitted	23	18
Died on parole	3	1
Discharged from parole on account prison sentence	23	55
Totals	321	411
On parole at end of year	601	598

TABLE No. 4

Statement of Furloughs

	June 30, 1926	*June 30, 1927*
On furlough at midnight	124	44
Furloughed during year	50	59
Totals	174	103
Discharged from furlough	14	13
Returned from furlough	8	16
Died on furlough	1	--
Recommitted from furlough	6	--
Paroled from furlough	101	8
Discharge from furlough on account prison sentence	--	4
Totals	130	41
On furlough at end of year	44	62

TABLE No. 5

Statement of Escapes

	June 30, 1926	*June 30, 1927*
Escapes at large at midnight	19	15
Escaped during year	20	25
Totals	39	40
Captured	9	9
Term expired	11	8
Discharged on account prison sentence	4	5
Totals	24	22
Total escapes at end of year	15	18

TABLE No. 6

Enrollment by Months

	1918-19	1919-20	1920-21	1921-22	1922-23	1923-24	1924-25	1925-26	1926-27	1927-28
July	276	366	376	400	446	472	489	550	559	583
August	257	352	374	409	446	468	521	540	542	581
September	251	330	361	392	420	416	556	484	546	553
October	273	328	356	410	431	440	565	511	553	555
November	249	344	351	424	441	467	553	512	563	578
December	259	345	357	435	441	491	555	534	572	612
January	289	365	372	445	447	505	552	561	579	624
February	324	361	383	450	453	528	539	553	584	594
March	356	376	382	454	468	535	529	540	572	623
April	371	388	378	445	471	513	544	554	590	622
May	375	380	390	447	489	521	557	563	605	623
June	365	383	396	447	496	557	552	574	577	621

TABLE No. 7

Showing Summary for Years

Year	Received				Discharged	Paroled	Order of court	Returned to court	Deported	Escaped	Died	Transferred to Whittier	Transferred to Sonoma	Furlough	Transferred to Stockton
	New	Returned	Transferred from Whittier	Transferred from Sonoma											
1894-95	174				6	3				7	2				
1895-96	59				10	4				10					
1896-97	79				20	47				17	1				
1897-98	28				51	14				7	1				
1898-99	51				51	5					2				
1899-00	31				22	21				7	1				
1900-01	31				37	20									
1901-02	59				33										
1902-03	36				37										
1903-04	63				33										
1904-05	80				23	10									
1905-06	90				28	40									
1906-07	92				31	46									
1907-08	146				7	40									
1908-09	182				17	82		3							
1909-10	201	2			34	162		12		2					
1910-11	199	29			17	179	6			2					
1911-12	192	36			29	195	16	5		13	2				
1912-13	253	61	137		24	193	33	3	3	18	4	14		2	
1913-14	248	126	8		64	124	51	5	2	66	4	45		13	
1914-15	269	162	2		56	223	21	16	4	125	2	41		9	
1915-16	268	79			57	215	19	13		38	2	1		16	
1916-17	213	67			55	162	23	2	2	8		2		27	
1917-18	192	46	5		76	188	25	25		41		6		18	
1918-19	239	33	53		42	133	20	10	2	9	1	7		15	
1919-20	282	49			32	177	18	14	4	38	2			28	
1920-21	299	71	12		43	208	15	21	1	58	2	4		17	
1921-22	390	58	11		48	202	53	35		32	3			35	
1922-23	409	67	10		54	253	34	18		49		2		27	
1923-24	589	73	8	1	29	236	67	4	160	37	1	8	4	64	
1924-25	590	64	10	2	18	280	55		224	16	4	5	1	68	
1925-26	618	72	6	1	20	306	28	8	184	16	2	3		108	
1926-27	618	77	7		11	351	26	2	233	20	2	3		50	1
1927-28	664	89	14		49	400	35		152	25	1		2	59	
Totals	7,934	1,261	283	4	1,164	4,519	545	195	971	662	39	141	7	556	1

TABLE No. 8

Showing Counties from Which Boys Were Received During the Biennial Period Ended June 30, 1928

Counties—	*1926–27*	*1927–28*	*Total*
Alameda	46	47	93
Alpine	--	--	--
Amador	--	1	1
Butte	1	1	2
Calaveras	--	--	--
Colusa	--	1	1
Contra Costa	1	--	1
Del Norte	--	--	--
El Dorado	--	2	2
Fresno	17	27	44
Glenn	1	--	1
Humboldt	4	13	17
Imperial	1	3	4
Inyo	--	4	4
Kern	5	8	13
Kings	1	7	8
Lake	--	--	--
Lassen	3	3	6
Los Angeles	371	359	730
Madera	3	2	5
Marin	--	3	3
Mariposa	--	--	--
Mendocino	--	--	--
Merced	--	--	--
Modoc	3	2	5
Mono	--	--	--
Monterey	1	1	2
Napa	2	--	2
Nevada	--	--	--
Orange	18	36	54
Placer	5	3	8
Plumas	2	2	4
Riverside	11	14	25
Sacramento	15	22	37
San Benito	--	--	--
San Bernardino	25	27	52
San Diego	37	45	82
San Francisco	39	51	90
San Joaquin	12	13	25
San Luis Obispo	5	4	9
San Mateo	1	5	6
Santa Barbara	11	5	16
Santa Clara	19	17	36
Santa Cruz	--	2	2
Shasta	--	3	3
Sierra	--	--	--
Siskiyou	4	3	7
Solano	2	5	7
Sonoma	4	4	8
Stanislaus	8	2	10
Sutter	4	1	5
Tehama	1	--	1
Trinity	--	--	--
Tulare	7	13	20
Tuolumne	--	--	--
Ventura	7	2	9
Yolo	1	1	2
Yuba	4	3	7
Totals	702	767	1469

TABLE No. 9

Number of Boys in School from Broken Homes, June 30, 1928

	Number	*Per cent*
Divorced	92	14.8
Both dead	37	6.0
Father dead	81	13.2
Mother dead	52	8.3
Totals	262	42.3

TABLE No. 10

Religious Affiliations of Boys in School, June 30, 1928

	Number	*Per cent*
Protestant	336	54.1
Catholic	225	36.3
Jewish	11	1.7
None	49	7.9
Totals	621	100

TABLE No. 11

Race Distribution of Boys in School, June 30, 1928

	Number	*Per cent*
White	480	77.13
Negro	25	4.02
Mexican-Indian	113	18.41
Oriental	3	.44
Totals	621	100

TABLE No. 12

Boys of Foreign Birth and Boys of Foreign Parentage in School, June 30, 1928

	Number	*Per cent*
Foreign born	49	23.7
Both parents foreign born	79	38.3
Father foreign born	39	19
Mother foreign born	38	19
Totals	205	100

TABLE No. 13

Boys in Preston School of Industry with Military Records, June 30, 1928

	Number	*Per cent*
Honorable discharge	5	.7
Dishonorable discharge	18	2.9
Totals	23	3.6

TABLE No. 14

Causes of Commitments of Boys in School, June 30, 1928

	Number	*Per cent*
Assault with deadly weapon	2	.33
Burglary	134	21.62
Carrying concealed weapon	1	.17
Extortion	5	.81
Embezzlement	3	.49
Forgery	51	8.05
Grand larceny	122	19.71
Immorality	8	1.29
Manslaughter	3	.49
Petit larceny	82	13.21
Rape	3	.49
Robbery	43	6.94
Selling liquor	1	.17
Receiving stolen property	1	.17
Sodomy	1	.17
Truancy	83	13.32
Violation of poison act	1	.17
Violation of section 146 (Motor Vehicle Act)	77	12.40
Totals	621	100

TABLE No. 15

Offenses of Mexican Boys in School, June 30, 1928

	Number	*Per cent*
Assault with deadly weapon	1	.89
Burglary	24	21.24
Carrying concealed weapon	0	0.0
Extortion	0	0.0
Embezzlement	0	0.0
Forgery	9	7.96
Grand larceny	22	19.47
Immorality	1	.89
Manslaughter	1	.89
Petit larceny	5	4.42
Rape	2	1.76
Robbery	5	4.43
Selling liquor	1	.89
Receiving stolen property	0	0.0
Sodomy	0	0.0
Truancy	9	7.96
Violation of poison act	1	.89
Violation of section 146 (Motor Vehicle Act)	32	28.31
Totals	113	100

REPORT OF THE SUPERINTENDENT OF THE WHITTIER STATE SCHOOL

Foreword.

In presenting a report of my superintendency of Whittier State School since my appointment, August 1, 1927, I should like to preface the statement by a sincere expression of appreciation for the generous support I have received upon the part of all the state departments. Particularly do we extend our appreciation to Director Earl E. Jensen and his efficient corps of assistants in the State Department of Institutions. Mr. Jensen has made frequent visits to the school, has become imbued with its unlimited possibilities on behalf of needy and deserving boys, and has constantly evidenced this interest in a very practical way.

With the passing of Fred C. Nelles in May of 1927, the state of California and boyhood generally suffered a real and lasting loss. Accepting the superintendency of Whittier State School in March, 1912, Mr. Nelles had found an institution in which fear and severe punishment were said to be predominating factors. A heavy leather strap was used in cases needing special discipline, and boys who ran away were required to wear a heavy iron "bracelet" known as the Oregon boot. With the advent of the Nelles administration the fundamental ideal that regeneration should be brought about by kindness, by educational methods, and the fostering of a proper conception of the home and of society, replaced the traditions and practices of the past, and gradually the State School at Whittier won for itself an outstanding place among schools of the kind. Upon assuming the superintendency August 1, 1927, I enunciated my belief in the soundness of the principles upon which my predecessor had builded. While many of these policies have been followed, naturally there are new fields and new scientific methods of approach which will be developed in the administration of the school, some of which have already been instituted with marked success. During the four years preceding my appointment, the school had necessarily been operated under a strict retrenchment program. The highly efficient and comprehensive research work evolved under the leadership of Dr. J. Harold Williams, which had won for the school and its Department of Research an eminent place in social welfare and scientific circles, had been suspended in 1923 until it was again revived on a part-time basis. In proportion, other important phases of our activities were functioning on a limited basis and the physical aspects of the school had suffered somewhat as a result. It was our early aim to improve such matters as the dietary, sanitation, condition of grounds and buildings, improvement of roads, etc., at the same time laying our plans to undertake the important developmental program we had in mind. Some of the projects carried out during the eleven months of my superintendency preceding June 30, 1928, are referred to in the following section:

Projects accomplished.

Cafeteria plan. Give a lad plenty of good food and you can reason with him.

One of the greatest problems in any institution is that of feeding.

Boys soon become tired of any routine institutional menu. Beans and stew too often compose the bill of fare.

Boarding house style of serving in large containers on each table soon wrecks table manners. Boys become finicky and pick over the best of foods, looking for tender morsels.

Some boy turns up his nose at vegetables and is followed by all the others at that table. Grabbing is encouraged, and conduct is bad.

Table cloths become soiled and must be changed almost daily. In short, there exists confusion, carelessness and discontent.

Under such conditions it is useless to advocate a balanced diet. The best of food goes on to the table and into the garbage. Food sent out in thermos containers to the cottages is also an unsatisfactory method of feeding. While we are strong advocates of a cottage system, we believe that food should be served under conditions in which the serving can be controlled. To deliver food to eight or nine cottages calls for early cooking and delivery, long before service is contemplated. Certain food values are lost in this way, often necessitating reheating. Then there is the problem of delivery three times a day.

These many problems have been solved by the installation of a modern cafeteria service in the boys' dining room at Whittier, where every boy in the school, including the Lost Privilege group under discipline, is served three hot and well prepared meals daily.

The class in bricklaying and tile setting installed a very beautiful brick and tile serving counter. The carpentry class built new tables with composition tops, a white center with green (Jaspé) border, doing away with all table cloths. Reed chairs were secured from the Norwalk State Hospital, and a very attractive cafeteria has resulted.

The effect upon the morale of the boys was electric. As one youngster remarked on seeing the cafeteria for the first time: "Gee, this is officers' stuff."

Each boy carries his tray, selects what he cares to eat, goes to his table and disposes of his meal in an orderly manner. Everything is cleaned up, vegetables which were taboo before are now eaten without question when placed on his plate with other food. If he does not care for carrots he says so, and passes on. The fact that the decision rests with him seems to act as an inducement to try food he otherwise would shun.

Plenty of rich, wholesome milk on the basis of a quart per day for each boy has also added greatly to the menu and the building up of young bone and tissue. Ice cream is served at least once a week and plenty of fresh fruits and vegetables round out the bill of fare.

Feeding in a central cafeteria allows more time for cottage activities and eliminates the work and effort to prepare three servings per day. The cafeteria plan almost eliminates waste, and food not disposed of at one meal can be worked in again later. We are convinced that the cafeteria plan is much more suitable for institutional feeding than any other known method.

Aside from the elimination of waste, the boys' table manners are much better.

Aluminum ware has been replaced with a good, heavy quality of white crockery and individual servings of salads and desserts make a very attractive and appetizing tray. With the installation of a modern dishwasher, the service has been adequate and dishes thoroughly cleaned, rinsed and sterilized.

This has all been accomplished in the old refectory building, which we hope to tear down next year. In spite of its age and worn appearance, we have been able to work out a very attractive cafeteria dining room to enable us to demonstrate the value and superiority of this type of feeding over the older method. This has only been made possible through the backing and kindly interest of our Director of Institutions, who is most insistent that state wards be fed in clean and sanitary surroundings, and that the food be of good quality and properly prepared. Miss Ilma Lucas, the state dietitian, has been most helpful in the introduction of our cafeteria plan, and the practical assistance rendered by Miss Lucas on her various visits has contributed much toward the success of the plan and for greatly improved conditions in our kitchen and dining room.

The many visitors who have inspected our cafeteria, particularly those from institutions of other states, have been a unit in commending the plan. It is to be introduced into other state institutions in California, and no doubt many of those other states whose representatives have visited us recently will also introduce the plan into their state institutions.

Fire hazard. We arranged for a complete inspection and report of our grounds and buildings by the chief of the Whittier City Fire Department and his assistant. The report was filed with the Department of Institutions, and practically all of its recommendations have been complied with.

The old frame cottage, which for some years had housed the younger boys, was torn down, and for the present the juniors are living in the recently remodeled building which was at one time part of the girls' department and subsequently used as headquarters for the Department of Research. In the removal of the old frame cottage a definite fire hazard was removed.

Limited facilities. A demand for accommodations within the school persists, and with the rapidly increasing population of this section of the state, it is becoming more acute with each succeeding year. We have striven to cooperate with the courts and probation offices throughout the state, to the limit that our facilities will permit. In February, 1928, after a strenuous campaign of adjustments, we were able to practically clear up the accumulated waiting list, a feat which had not been accomplished for years. Within a few weeks, however, the waiting list had again almost attained its usual proportions. We heartily endorse the effort some of the counties are making to provide additional facilities within their own borders for the care and training of predelinquent and maladjusted children. We commend to the careful consideration of the county educational authorities the twenty-four hour school plan of the late Fred C. Nelles, a preventive measure which

would provide for schools directly connected with and under the control of boards of education, and operating on a twenty-four hour basis. In such schools might be placed exceptional children, those who do not fit into the "average mold" plan upon which the public schools are necessarily conducted. Such children are misunderstood, their reactions misinterpreted, and many of them eventually reach the state schools as "delinquent," when had their need been properly diagnosed and met they would in most instances have been saved a court experience and the stigma of commitment to a state school. The twenty-four hour school is recognized as socially and economically sound, and has the endorsement of leading welfare workers and educators.

New buildings. The State Department of Public Works plans for the construction of a new administration building, new hospital, and two cottages early in the fall, out of the moneys appropriated at the last session of the legislature. These additional cottages, however, will permit of no actual increase in our population, in that they will simply provide adequate quarters for groups now unsuitably quartered. We are hopeful that the building program outlined for the next biennial period will provide for an actual increase in the school's capacity.

Athletics and physical education. A program of intensive physical education and athletics has been carried out under the direction of an instructor with years of high school experience. While we still build up representative school teams in the various classifications, and these teams have won a very commendable proportion of the contests played, our first consideration is to stress the idea of physical education for each and every boy. In place of concentrating on the developing of "star" athletic teams, we now insist on practically every boy engaging in athletic contests, and out of a series of elimination games are able to select boys who are outstanding in each sport, but this takes place as an incidental rather than a primary part of the physical education program. Our commodious gymnasium makes it possible to include periods of physical education in the daily program of each boy. Incidentally we have about completed the strenuous task of changing the level and direction of our athletic field. A seven-foot cut at one end, and a similar fill at the other end of the field was essential, in order that we might have a "stadium" with a really level field. This project was accomplished almost entirely by the boys and involved the transfer of many thousands of yards of dirt at a minimum of cost to the state. Boys worked incessantly at this project, even giving up their Saturday afternoon play time to further the job, and cottage groups competed to see which could move the greatest volume of dirt in an afternoon. When the field is completed we will have a bermuda grass turf field with a quarter mile track and a two-twenty straightaway.

Roads. The main roads through the grounds, which for years have been a quagmire in winter and a persistent dust nuisance in summer months, have been resurfaced. After scarifying, new gravel was added, rolled in and coated with oil to which in turn was applied a liberal coating of crushed rock. Real economy was effected in the accomplishment of this job, in that we had one of our own men with the necessary experience, operate the steam roller which we were able to borrow

without expense to the school. Our roads are now in much better shape than ever before.

The cottage known on the official records as Band Cottage, was remodeled at small expense, providing living rooms in addition to already existing quarters, for two groups of boys who had been inadequately housed in this same building.

Catalina camp. The Catalina Island camp, which has been maintained for the boys for a number of years, and has been made possible through the generosity of Mr. William Wrigley and his associates in the Wilmington Transportation Company, has proved to be a most important adjunct. Many boys who had never experienced the joys of a real vacation have had this first opportunity to enjoy to the limit the delights of swimming, boating, hiking and camping de luxe. The old tents used in previous years had become so dilapidated it became necessary to replace them. A convenient and commodious dormitory of forty beds and a mess hall was constructed by a specially selected group of carpenter shop boys, as a special project. An oil burner range replaced the old open fire box. A fresh water supply was developed and piped down from the hills in the rear of the camp with a 10,000-gallon tank for storage purposes, allowing hot and cold water in the kitchen, and new and modern lavatory facilities were provided. The added comfort and enjoyment this has meant for the boys is apparent to all who have visited our 1928 camp. The camp was visited by the county health officer who stated, after his inspection, that the 1928 camp was far in advance of that of 1927, both in point of sanitation and general appearance. He expressed the hope that other groups conducting camps on the island could profit by visiting the Whittier State School camp and following out the plan and methods in use.

Clothing. The khaki shirt and trousers, which for years have constituted the week-day costume, is being rapidly replaced by neat appearing corduroy trousers and colored shirts of appropriate design and without added expense. The boy is not entitled to his new outfit until his general record is meritorious and thus the new plan becomes automatically a valuable asset in our program of discipline. The dream of many a lad for a pair of "cords" has thus come true.

New developments in plan and policy.

In the foregoing paragraphs concerning accomplishments during the year, we have necessarily been limited by time and space to the enumerating only of the more important projects, and many worth-while "jobs" of lesser importance but all of value in the efficiency of our general program were completed or are definitely under way. This has enabled us to turn attention to the development of plans and policies which we believe will have far-reaching effect on the future of the school.

The superintendent was honored by Governor C. C. Young with appointment as member of the California Commission for the Study of Problem Children, a commission of seven members, appointed as the result of an act passed by the 1927 session of the legislature. The purpose of this commission, of which the writer was made executive secretary, is "in conjunction with the Bureau of Juvenile Research of the

Whittier State School, to make a study of juvenile delinquency in the State of California and to report and recommend to the legislature of the State of California at the forty-eighth session thereof, a plan for the prevention of juvenile delinquency and the proper care and training of predelinquent, delinquent psychopathic and maladjusted children, such as in the opinion of the commission will be best calculated to remove the causes of juvenile delinquency and provide for the care and treatment of such children." The commission has already held a number of important conference sessions and is accumulating a valuable fund of data on this highly important problem. From this data it is anticipated that some very worth-while recommendations may be developed. The time allotted for the study, however, has been too limited to permit of as comprehensive or conclusive a report as the study warrants.

We are particularly pleased to report the appointment of Dr. Ernest A. Osborn as school chaplain, full time. It is particularly fitting that with boys scaling down to eight years of age, many of whose lives have been almost wholly devoid of religious influence, this important phase of the school life should now be properly cared for. The various ministers of the city of Whittier, who for years had carried the responsibility for the religious services, made an excellent contribution, but they all attest to the value of the service which a full-time chaplain can render. Dr. Osborn's work has not been confined to the purely religious field, for he has actively participated in the Boy Scout work, being chairman of the Troop Committee, and in all of the social and ethical activities of the school.

Vocational survey. It is and has long been our firm belief that the vocational education approach will do much toward a solution of the problem of delinquency in young boys. We therefore requested of the Department of Institutions that the expert assistance of the State Department of Education be secured for the purpose of conducting a searching survey of our trades departments. The survey was outlined by Mr. Nicholas Ricciardi, chief of the Division of City Secondary Schools, and was ably conducted under the direction of Mr. J. C. Beswick, chief, Bureau of Trade and Industrial Education.

A report of this survey was recently submitted and we desire to express appreciation for the many complimentary references as well as the definite recommendations it contains. One prompt reaction to the survey findings was the taking of the summer course at the University, by a group of our tradesmen. These men anticipate that with the completion of the course they will receive special vocational certificates, thus placing our vocational service on a plane with the educational in point of technical qualifications. Another important development is in the service now being rendered as Director of Vocational Guidance and Placement, by Mr. C. K. Berger, until recently principal of the Pasadena Part-Time High School. Mr. Berger is specially qualified for this important piece of work, both in point of experience and training. He will program the full day's activities for each boy, will assist in coordinating the vocational with the educational training of each, and stress outside placement that will conform with the type of training the boy has experienced in the school. As a result of the survey we

are developing a general shop through which most of our boys will pass in an effort to discover definite trade aptitudes. Twelve trades will be represented in the general shop, and each new boy will be required to spend some two months in this shop, taking some work in each of the twelve trades in order to determine his interests and adaptability, etc. This, then, will obviate much of the trial and error method of trade placement which has necessarily been the policy heretofore, and should increase the boy's earning capacity in the line for which he is best fitted.

Dramatics and music have received an emphasis which we believe to be their just due. The desire to "play act" has a tremendous appeal to the youngster of the average age of our boys. Several excellent plays have been presented. Outstanding was the presentation of Drinkwater's "Abraham Lincoln." So successful was this showing that the play was repeated and the public invited to the second presentation, which occurred during the conference of state institution superintendents and other state officials, May 2 and 3, 1928. Countless expressions of surprise and pleasure were elicited as a result of the splendid presentation of Drinkwater's immortal play.

Our band has maintained the high standard of many years standing, and its services have been in constant demand by many groups and organizations. In some cases a handsome addition to our general entertainment fund has been realized, as a return to cover expenses of trips made, and thus all the boys have experienced a beneficial reaction because of band activities. Enjoyable group singing has taken place during our Sunday and Thursday evening assemblies under direction of a teacher specially qualified along musical lines, and a glee club is well under way. We continued under heavy obligation to the Los Angeles Film Board of Trade, who for years have maintained gratis picture service. We are indebted to the many good friends, too numerous to mention, who have in any way added to the success of our entertainment programs. These weekly entertainments have proven a valuable asset to the school's functions. We organized and for some months conducted a harmonica band and the wholesome cheerful sound of the harmonica was heard on every hand.

Following my appointment we operated the school for a number of months without an assistant superintendent. This gave the superintendent opportunity to familiarize himself with the business procedure of the school and to keep a close check on budget expenditures and the general business life of the institution. In March of 1928, Mr. Charles A. Moss was appointed as assistant superintendent. Mr. Moss has supervised the operation of our farm and has assumed responsibility for our business practice and procedure. Under his direction there has been a marked improvement in the quality and diversity of agricultural products.

The educational program has been conducted as in previous years, but with the opening of the fall 1928 semester of school we are stressing the trade related technical subjects, in line with the policy already outlined. In our commencement exercises we graduated two high school and fifty-two grammar school students. The exercises were simple but impressive, the principal address being made by Principal Howard A. Campion of the Frank Wiggins Trade School.

The Placement Department of the school had heretofore been operated by one supervisor who was responsible for the placement and follow-up work of more than two hundred twenty-five boys on the placement rolls. Two additional supervisors have been added to the personnel of the department, which will also have the cooperation of a trained psychiatric social worker, connected with our Department of Research. It is expected that a more efficient and comprehensive type of work will result.

Training personnel. As is undoubtedly true of other state institutions we have been faced with the ever-present problem of developing and training competent workers. The average state employee doing institutional work receives the major part of his training in the "school of experience." Every superintendent has at some time expressed the opinion that if there were some agency from which he could draw an unending supply of competent workers his problems would be much nearer solution. This is particularly true in our work with the younger boys at Whittier. Realizing that there is no competent source from which to secure trained institutional workers, we are developing a program for training our own workers on the job. An extensive personnel turnover is expensive for any organization. We are stressing job analyses, determining just what are the requirements for each position. We are also stressing the occupational and intelligence test in the selection of employees for certain lines of work. We aim to give each new employee a perspective of the entire organization, and to this end are developing the "Whittier Plan" for the administration of a state school. Illustrated lectures will be given. These will also be helpful in enlightening visiting classes of students, social workers, and the general public, giving such groups an adequate concept of how this type of institution should be conducted. New employees will have opportunity to attend these lectures. They will be shown through the institution and given an opportunity to talk with other employees. They will be presented with a copy of our "Faculty Guide," an attractive little booklet prepared by our print shop, setting forth the general understanding under which we operate. Our employees will not only have opportunity, but will be urged to make use of the facilities of our Research Department. They will be made to feel free to discuss with the superintendent the problems which develop in their jobs.

The personnel conference which we hold each month gives opportunity to discuss the various problems of the school. The conferences are attended by the entire personnel, the superintendent acting as chairman. Here the employees meet the superintendent face to face, listening to instructions, asking questions, and engaging in discussions. Each employee feels that he is a part of the organization, and that a greater knowledge of his particular job is a great factor in its efficiency. Uncertainties and doubts are cleared up, gossip minimized, and a healthy, wholesome attitude developed.

Occasional employees' parties also provide another avenue of approach toward the adjustment of the new employee. Institutional life at best is full of monotony for the average worker, and in these social gatherings he has opportunity to unbend, to mingle with fellow workers, and to become better acquainted with them. The effect on

the morale is very noticeable. We have already observed a considerable decrease in our personnel turnover, and believe this will soon be further evidenced.

Clinical approach. For some time we have realized that we have been failing to make use of a wealth of data concerning each boy. It has been evident to us that important decisions affecting each individual should be based upon a full and complete knowledge of all the facts available. To this end we are developing a clinical approach. As soon as possible after the entrance of each boy, all the data available concerning his record, his intelligence, and every helpful phase of his life, will be accumulated in clinical form which will be available for the use of committees or staff members, developing a definite program for the boy inside the school, and in planning for his placement when the time comes for him to leave.

The board of trustees of the school, who serve in a purely advisory capacity, have been invited to resume the practice of holding occasional conferences. The interest of these prominent citizens we have found exceedingly helpful and of much value.

From time to time we have been visited by interested groups and have enjoyed the contact possible with the interested social workers and organizations having a scientific viewpoint. Among such visitors were the Vocational Guidance Association, over one hundred from the Federated Women's Clubs, psychological classes from a number of southern universities and colleges, the Los Angeles High School Principals' Association, California Commission for the Study of Problem Children, and many other interested groups. We appreciate the interest of all these organizations and extend a cordial welcome for a return visit.

California Bureau of Juvenile Research. On June 30, 1928, Dr. Ellen B. Sullivan, associate professor of psychology, University of California at Los Angeles, who for approximately two years has directed the Department of Research on a part-time basis, resigned to give full time to her university studies. Succeeding Dr. Sullivan, we were fortunate in being able to secure Dr. Norman Fenton, who resigned a position as professor of psychology in Ohio University to accept this new responsibility. Dr. Lewis M. Terman, dean of the Department of Education of Stanford University and universally known in educational and psychological circles, on learning of Dr. Fenton's appointment, made this significant statement: "In my opinion, you couldn't have made a better choice if you had combed the United States over." Since Dr. Felton's directorship begins after the close of the biennium which this report is presumed to cover, we quote from an informal statement which he had prepared for another purpose but which admirably outlines the progress of his department thus far, and gives an interesting insight into the scope and practical character of the aims which it is hoped to accomplish.

The report refers to the increase in the study and follow-up work now being done with individual boys. In addition to the routine testing which has heretofore been used, it is the plan of the department shortly after admission to interview each boy, studying him from many angles of personality. The examiner will interview the boy not only on the basis of a psychological test, but from the standpoint of his

attitude toward authority, toward his parents and the community and toward other phases of social adjustment.

The Research Department is now able to state that there is on record a valid intelligence test of every boy now in the school, nineteen boys having been tested during the current month. In addition, new boys entering were given educational tests to locate them in school. Such tests were also given to all the boys in our Receiving Cottage, a total of twenty-eight, and the machinery set in motion for the transfer of this information to our school department so that it can be put to practical use. Efficient cooperation between the Research and the School Department is facilitated by the addition of an educational counselor, who will cooperate with the school principal and teachers in adjusting the school work of all new boys. This is an exceedingly important feature of our program, inasmuch as many of the boys whom we receive are backward in school work and also show great differences in ability in different subjects. The educational counselor will also cooperate with the principal and teachers in planning a reading program for the boys. We are firm believers in the theory that what a person reads has a definite relation to the thing that is in his mind. This reading program will be in line with the most recent scientific advances in the matter of children's reading. The educational counselor will also cooperate with the vocational director in giving tests of vocational interest and aptitude, conferring with those in charge of our vocational program in regard to the proper selection of trades for the boys.

The name "Journal of Delinquency" has been revised to "Journal of Juvenile Research," in referring to the periodical issued by our Department of Research. The editorial staff has been reorganized, and twenty widely known scientists in the field of child guidance and juvenile research have expressed a willingness to act as members of the editorial board.

Attention is also called in the report to the activities of a psychiatric social worker, who is not only continuing the policy of making a thorough study and report on the home of every boy at as early a date as possible, after admission, but is also making contact with the boys in the school and, in a sense, becomes the connecting link between the home and the school, having the information regarding the home background of the boy as well as the behavior and attitude in his cottage, and other activities of his school life. The importance of an early study and report of the home conditions can not be too greatly emphasized, for it is the keynote to the whole situation in the social readjustment of the Whittier State School type of boy. Unless all those in the school concerned with the guidance of the boy understand something of his problem of readjustment when he returns home, his program is likely to be inadequate or in error.

In concluding this brief report we would like to express an optimistic viewpoint toward progress made and the possibilities that lie ahead. As the report indicates, there has been much of worth while accomplishment and definite development in the educational, vocational, research and clinical approach to these problems. We commend the loyal, efficient cooperation of the school personnel during the eleven months of our superintendency, and this spirit of helpfulness has been a big factor in making our progress possible.

We extend our appreciation to all the many friends who have in countless ways contributed to the success of our effort during these recent months. Particularly do we thank the Wilmington Transportation Company for the free transportation and camping facilities at Catalina Island, the Los Angeles Film Exchange for continuous free film service, to Dr. Edwin Wayte, superintendent of Norwalk State Hospital, for the clinical assistance rendered us in the study of problem cases; to Dr. E. Van Norman Emery, director of the Child Guidance Clinic in Los Angeles, who with an already heavy program managed to find time to make a clinical study of certain of our problem cases.

Expansion program. Outstanding among our needs for the future development of the Whittier State School we would like to stress the need of enlarging our facilities. We believe that as early as possible we should increase our capacity to provide for a population of five hundred boys. In achieving progress toward this aim we are recommending the appropriation of money for the following buildings, in addition to those to be constructed during the current biennium:

At least two additional boys' cottages.

A refectory building, to contain kitchen, cold storage, dining room, cafeteria and commissary, as well as a bakery, which should probably be a separate structure.

Additional trades buildings, equipped to enable extensive expansion of our vocational program.

Additional school buildings and equipment, thus providing a primary school for our smaller boys; this to include equipment for manual training and should have a capacity of two hundred.

We believe that at as early a date as consistently possible, the matter of bringing water from our river bottom well to the school grounds should be definitely headed up. This would obviously mean a tremendous saving and would be of immeasurable convenience in connection with our irrigation and crop rotation. We also strongly recommend the purchase of additional acreage advantageously located in close proximity to the main school. For the accomplishment of this purpose we recommend the sale of such portion of the school property located at the southern end of the grounds as may be necessary.

We also recommend for careful consideration the establishment of a state hospital school to provide care for psychopathic children. It is equally important that state facilities should be further developed to care for the young defective delinquents. We have in our school a number of boys of both these types. They represent a complex and difficult problem, requiring a far greater degree of supervision, care and study than is necessary in the case of normal boys. Realizing the embarrassment of the various counties by reason of the lack of a state institution of this type, we have accepted a limited number of these abnormal cases, but believe such boys could be more adequately and more economically cared for in state institutions properly equipped for the type of specialized training they need.

In conclusion, we are submitting herewith the statistical tables prepared by the school secretary, for the biennial years 1927–1928. These tables are attached hereto.

K. J. Scudder,
Superintendent.

STATISTICAL TABLES, WHITTIER STATE SCHOOL

Biennial Period, July 1, 1926, to June 30, 1927, and July 1, 1927, to June 30, 1928

Table number

1. Pupils Received by Commitment, 1891–1928.
2. Statement of Actual Population in Institution.
3. Statement of Placements.
4. Statement of Approved Absences With Leave.
5. Statement of Absences Without Leave.
6. Ages at Commitment, Admitted July 1, 1891, to June 30, 1928.
7. Race Distribution of Boys Admitted July 1, 1891, to June 30, 1928.
8. Religious Affiliations of Boys Admitted July 1, 1912, to June 30, 1928.

TABLE No 1

Pupils Received by Commitment, Probation and Voluntary Admission, 1891-1928

Year	*Boys*	*Girls*	*Total*	*Biennium*
1891–92	253	58	311	311
1892–93	202	39	241	---
1893–94	180	33	213	454
1894–95	128	24	152	---
1895–96	125	27	152	304
1896–97	60	28	88	---
1897–98	61	18	79	167
1898–99	94	21	115	---
1899–00	76	14	90	205
1900–01	55	13	68	---
1901–02	65	19	84	152
1902–03	81	23	104	---
1903–04	125	19	144	248
1904–05	98	12	110	---
1905–06	96	16	112	222
1906–07	85	21	106	---
1907–08	87	36	123	229
1908–09	91	39	130	---
1909–10	96	46	142	272
1910–11	100	40	140	---
1911–12	105	39	144	284
1912–13	85	46	131	---
1913–14	44	2*	46	177
1914–15	81	--	81	---
1915–16	98	--	98	179
1916–17	96	--	96	---
1917–18	167	--	167	263
1918–19	167	--	167	---
1919–20	126	--	126	293
1920–21	168	--	168	---
1921–22	147	--	147	315
1922–23 By commitment	150	--	---	---
On probation	26	--	176	---
1923–24 By commitment	186	--	---	---
On probation	8	--	194	370
1924–25 By commitment	175	--	---	---
On probation	5	--	180	---
1925–26 By commitment	169	--	---	---
On probation	4	--	173	353
1926–27 By commitment	133	--	---	---
On probation	5	--	138	---
1927–28 By commitment	177	--	177	315
Totals	4480	633	5113	5113
Received by voluntary admission—				
1922–23	7	--	7	---
1923–24	5	--	5	12
1924–25	7	--	7	---
1925–26	2	--	2	9

* By act of legislature, June 14, 1913, the Girls' Department of Whittier State School ceased to exist, and became the California School for Girls, now located at Ventura.

TABLE No. 2

Statement of Actual Population in Institution

Received during the year—	*June 30, 1926*	*June 30, 1927*
In institution at midnight	320	299
By new commitment and on probation	135	177
By return from placement	42	36
By return from approved absence	1	1
By return from absence without leave	4	21
By transfers	3	0
By voluntary admission	0	0
Total received	185	235
In institution during the year	505	534
Passed out during the year—		
By discharge—By order of the court	36	21
By discharge—By order of superintendent	2	4
By expiration of sentence, term of commitment	0	0
By placement	154	156
By approved absence	3	1
By absence without leave	3	31
By transfer	7	14
By death	0	0
By release from remaining voluntarily	1	2
Total passed out	206	229
Total population at end of year	299	305

TABLE No. 3

Statement of Placements

	June 30, 1926	*June 30, 1927*
On placement at midnight	214	202
Transferred from approved absence to placement	0	1
Placement during the year	154	156
Totals	368	359
Discharged from placement—		
By order of superintendent	122	58
By order of court	0	0
Term expired on placement	1	1
Returned from placement	42	36
Died on placement	0	2
Removed from placement	1	0
Transferred to Preston School of Industry	0	0
Totals	166	97
On placement at end of year	202	262

TABLE No. 4

Statement of Approved Absence

	June 30, 1926	*June 30, 1927*
On approved absence at midnight	0	1
Approved absence during the year	3	1
Totals	3	2
Discharged from approved absence—		
By order of superintendent	0	0
By order of court	1	0
Returned from approved absence	1	1
Transferred from approved absence to placement	0	1
Died on approved absence	0	0
Removed from approved absence	0	0
Term expired while on approved absence	0	0
Totals	2	2
On approved absence at end of year	1	0

TABLE No. 5

Statement of Pupils Absent Without Leave

	June 30, 1926	*June 30, 1927*
Absent without leave at midnight	3	1
Absent without leave during the year	3	31
Totals	6	32
Returned from absence without leave	4	21
Term expired while absent without leave	1	0
Discharged while absent without leave	0	3
Died while absent without leave	0	0
By commitment to other institution	0	0
By order of court	0	0
Totals	5	24
Total absent without leave at end of year	1	8

TABLE No. 6

Ages at Commitment, July 1, 1891, to June 30, 1928

Age of commitment—	*1927–1928*	*Per cent*	*1891–1926*	*Per cent*	*1891–1928*	*Per cent*
Seven	---	.000	2	.048	2	.046
Eight	3	.953	29	.696	32	.714
Nine	10	3.211	58	1.392	68	1.517
Ten	12	3.747	132	3.169	144	3.214
Eleven	16	5.095	191	4.585	207	4.620
Twelve	36	11.438	367	8.811	403	8.993
Thirteen	57	18.096	564	13.541	621	13.866
Fourteen	111	35.238	851	20.432	962	21.473
Fifteen	66	20.954	972	23.343	1038	23.169
Sixteen	3	.953	507	12.172	510	11.384
Seventeen	---	.000	388	9.315	388	8.661
Eighteen	1	.315	64	1.536	65	1.451
Nineteen	---	.000	29	.696	29	.647
Twenty	---	.000	11	.264	11	.245
Totals	315	100	4165	100	4480	100

TABLE No. 7

Race Registration of Boys Admitted, July 1, 1891, to June 30, 1928

Race—	*1927–1928*	*Per cent*	*1891–1926*	*Per cent*	*1891–1928*	*Per cent*
White	259	82.223	3674	88.212	3933	87.790
Negro	21	6.667	313	7.515	334	7.455
Mexican-Indian	33	10.474	161	3.865	194	4.330
Yellow	2	.636	17	.408	19	.425
Totals	315	100	4165	100	4480	100

TABLE No. 8

Religious Affiliations of Boys Admitted, July 1, 1912, to June 30, 1928

Religion—	*1927–1928*	*Per cent*	*1912–1926*	*Per cent*	*1912–1928*	*Per cent*
Catholic	87	27.619	602	31.700	689	31.120
Jewish	3	.952	32	1.685	35	1.582
Protestant	170	53.969	1041	54.820	1211	54.696
Not stated	55	17.460	224	11.795	279	12.602
Totals	315	100	1899	100	2214	100

REPORT OF SUPERINTENDENT OF THE VENTURA SCHOOL FOR GIRLS

MR. EARL E. JENSEN, *Director,*
Department of Institutions,
Sacramento, California.

DEAR SIR: During the biennium ending June 30, 1928, the following work has been completed under the supervision of the Department of Public Works:

New poles for electric lines to replace those in bad condition; all installations in accordance with ruling of the Railroad Commission.

A new laundry building and drying yard; some old equipment, and one new mangle and water softener installed.

Old laundry room in Rio Vista cottage changed into four small rooms for girls. Change of heating plan in this cottage, and installation of new hot water boiler.

Painting of exteriors of all buildings and necessary interior work.

Repairs of heating system for Manor House and commissary rooms. Repair of steam boiler in Auditorium building.

Cementing two tennis courts and additional cement walks where necessary.

Reenameling of 12 hoppers in treatment room of Hospital building has been started.

Enlargement of Manor House kitchen.

Installation of pasteurizer and steam boiler with which to operate it.

Outer doors in two cottages.

Metal linings in refrigerators.

The general repair work and installation of replacement equipment has been done by the men employed by the school.

Farm. The citrus orchard has produced abundantly and, in fact, lemons and a few oranges have been sold locally.

Of the deciduous fruits, the apricots yielded very well in 1927. Most of the fruit was canned in glass or dried at the School, and there were 1600 pounds of dried fruit sold to other institutions. The 1928 crop was not so large as the 1927 crop, due to peculiar weather conditions during the blooming season.

The peaches produced poorly in 1927, and there is no fruit for the 1928 season.

The apples have borne only fairly well, and the prunes not at all.

The vegetable garden, which is under the direction of two women, is cared for by the girls, and has given a variety of vegetables the year around. Poor seed and seed not properly labeled by the seed companies have resulted in crop failure at times, and due to the fact that the garden is a mile from the school and close to other habitation, there has been considerable theft of vegetables.

The dairy has produced a quantity of wholesome milk. A pasteurizer has been added to the equipment and now all milk passes through it before distribution.

The hogs have given satisfactory results, and at the close of the biennium there are a number of shoats which will be offered for sale in the near future.

Commitments. During the biennium there were 220 girls admitted to the Ventura School for Girls from 30 counties of California. The lowest number received in any one month was 5, and the highest 14.

Two hundred eleven girls were committed through the various juvenile courts of the state. Most of the causes for commitment of this group are indicated in subdivisions 2, 9 and 11 of section 1 of Juvenile Court Law. A few felony charges appear in this group, but in most of the girls' histories waywardness and incorrigibility form the basis for court action. Nine were sent from the criminal courts for the following offenses: Two issuing fictitious checks, four forgery, one bigamy, one burglary, one receiving stolen property.

The following table indicates the number from various counties:

Alameda	11	Sacramento	8
Butte	5	San Bernardino	5
Colusa	4	San Diego	11
Contra Costa	4	San Francisco	29
Fresno	9	San Joaquin	5
Humboldt	6	San Luis Obispo	1
Kern	4	San Mateo	3
Lassen	3	Santa Barbara	2
Los Angeles	61	Santa Clara	10
Madera	3	Shasta	3
Merced	1	Solano	1
Monterey	6	Sonoma	3
Nevada	1	Tulare	4
Orange	5	Ventura	2
Riverside	9	Yuba	1
Total			220

The youngest girl received was 11 years of age, and the oldest 20 years and 8 months. Average age, 16 years, 5.6 months. The provision allowing courts to commit girls for two years who are over 19 and under 21 years of age has been used where the committing magistrate thought it for the best interest of the girl. On the whole, this group has been cooperative and nondetrimental to the younger girls in the school. Relief has been asked in two cases of this type during the biennium, and met with immediate cooperation by the committing court.

Ages at Commitment, July 1, 1926, to June 30, 1928

Eleven	2
Twelve	3
Thirteen	4
Fourteen	16
Fifteen	37
Sixteen	50
Seventeen	47
Eighteen	34
Nineteen	17
Twenty	10
Total	220

The following interesting data has been gleaned from the histories of the 220 girls who entered the school during the biennium, and indicates to what extent the broken home has figured in the group:

Parents living together	55
Parents living, abandoned child	1
Parents living, separated	10
Without parents	19
Both dead	12
Mother dead, father unknown	6
Mother dead, father in Folsom Prison for long term	1
Both parents in San Quentin	1
Mother in San Quentin, father dead	1
Mother dead, father living	37
Remarried	12
Mother living, father dead	41
Remarried	22
Mother living, father's whereabouts unknown	13
Father living, mother's whereabouts unknown	2
Father living, mother in hospital, insane	1
Foster children	11
Divorced	28
Mother remarried	22
Father remarried	1
Both remarried	3

Of the 220 girls, 67 have had previous commitments to other institutions, and several girls have been in two institutions before reaching the Ventura School for Girls.

During part of the first year of the biennial period Dr. Ellen Sullivan, from the Department of Research, Whittier State School, gave mental tests to girls who had not been examined in this manner. No tests of this character have been made for some time. It is not the purpose of this institution to instruct the feeble-minded, and there is not a sufficient teaching staff to provide such individual help as is needed when feeble-minded girls are mixed with normal girls. Most of the probation officers are careful to keep this in mind when recommending commitment to the court, but a few girls of low mentality have reached the school. The psychopathic girls present distinct problems in a school of the character of the Ventura School for Girls, as they do not react normally, and many of them are so unstable that it takes very little out of the ordinary to keep them upset.

All new girls enter the institution through the Medical Department, which is in charge of Mabel T. Bell, M.D.

Each girl is assigned a room in the hospital upon entrance, where she remains until it can be demonstrated that she has no contagious disease. After the few days of isolation she is welcomed into the hospital family group, where further medical examination can be made of her.

Treatment for girls suffering from venereal infection is started immediately, and members of this group are kept in the hospital building until they are recommended for transfer, by the resident physician, to one of the girls' cottages. After this change in residence they return at stated intervals for further examination and treatment, if necessary.

There has been a minimum of acute illness in the school during the biennium because of attention to minor complaints, putting girls to bed who have a rise in body temperature, and by the application of simple prophylactic measures so as to prevent illness in the first instance.

The new sterilizing plant in the hospital department, which replaced one that had become inadequate for the needs of the institution, is a great help in the work and is very much appreciated.

The nursing division has one graduate nurse and a group of pupil nurses from the student body. This work is a special privilege, and is

therefore a very popular detail. These girls have more liberty on the grounds than others, have personal dresses, and outings off the grounds, including a week's camping trip each year.

Training in the care of the sick is taught by the head nurse, and such fundamental subjects akin to their work as to give the pupil nurse a foundation for future work either in or out of a hospital.

The service of a dentist has not been as steady as in former periods, but the necessary work on the girls' teeth has received attention by a visiting dentist from Ventura.

So that the greatest number may benefit from the facilities for educational training privileges at the school, the Stanford achievement test, a measure of educational accomplishment, is given each girl as soon after entrance as possible. The result of this test is one of the important factors used in outlining the girl's daily program. Each girl is required to have fundamental training in cooking, dining room work, laundry, housekeeping, vegetable garden, and sewing during her residence in the school. Flower garden work and weaving are not required details, but most all girls have both of these, as they are used for new girls.

The light work in the outdoor air on the lawns and among the flowers, for part of the day, with weaving or basketry completing the day's program, is beneficial and interesting. This, with the friendly spirit shown by all of the women in charge of the groups, very soon causes the new girl to change her attitude of fear and resentment to one of helpfulness and interest in accomplishment.

The cooking, dining room work, housekeeping for the hospital and receiving building are assigned to girls of that cottage, and as soon as the girl is transferred to a resident cottage such additional details as laundry work, vegetable garden, sewing, may form part of the program. The daily program of each girl is made each month at the main office. School superintendent, sewing instructors, and physician are consulted in developing these details of work so that each girl will have not only fair and just treatment, but will have an opportunity to develop to the fullest extent along lines most suited to her ability.

After three months in elementary sewing has been completed, more time is allowed any girl in dressmaking if she shows ability in this work.

The aim of the sewing department is to teach a girl the fundamental principles of sewing that will enable her to make her own clothing and efficiently supervise the equipment of a home with suitable linens. Vocational training as such is presented only in the foundation work in technique and training in judgment of quality and values. In the class in elementary sewing practical experience in the making of all clothing and linens used in the institution is provided. The advanced class in dressmaking supplies the wardrobes of the girls leaving the school.

Much attention is given to the attractiveness of these outgoing wardrobes. Daintily trimmed underwear of pastel colors is provided, also cotton dresses of prints made in the approved fashion of the day, while bright colored dresses of wool jersey or flannel have replaced the time honored blue serge for street dresses. The restoration of self-respect is

of greatest importance in the rehabilitation process, and clothing that is both serviceable and attractive is a great incentive to self-respect.

The supervision of each cottage is under the direction of a house mother, who has as assistants a kitchen matron and an inside night watch.

The kitchen matron teaches the girls to cook and serve the meals which are prepared for the cottage group of from 25 to 30 girls, house officers, and in some cottages two or three teachers. Meals must be on time so that the day's program may move smoothly, and must be well balanced and contain such elements of variety and flavor as to insure not only body building but satisfaction to the participants. A variety of fruit and vegetables from orchard and garden, milk from the School dairy, added to supplies purchased, give ample materials for a varied and interesting daily menu.

There is a night watch in all cottages except the honor cottage, and her duty is to supervise carefully the dormitories at night.

The one cottage which does not have a night watch has for its population girls who have made an excellent record in deportment and conduct. The privileges are increased here; girls are allowed to go to entertainments and picnics in the vicinity of Ventura, and are allowed a two-weeks' camping trip each year with their two house officers.

The maintenance of an honor cottage acts as a source of constant stimulation to the girls to do their best so that they may in time be moved there and be accorded the additional privileges which this family group enjoys.

The academic educational program for both years of the biennium consists of full-time school work for all girls of school age, and part-time courses of a practical nature for older girls.

Beginning the second year of the biennium it was necessary to increase facilities for older girls, as about one-third of the population was composed of girls who had attended high school before entering this institution. September 1, 1927, classes were increased to include two in shorthand, two in typing, one in bookkeeping and one in retail salesmanship.

In the latter class were placed older girls other than high school girls, when it was thought advantageous to do so.

In formulating plans for classroom work for any and every year at this institution it is necessary to analyze the human material at hand, so that the classes and courses of study may be best suited to the needs of the particular group which presents itself at that time.

Fifteen girls in June, 1927, and eighteen girls in June, 1928, were graduated from the eighth grade and received Ventura County diplomas. Fitting and appropriate ceremonies were held in the auditorium in each instance, with a prominent citizen as speaker of the day, and an audience increased to capacity by invited guests from far and near, and such relatives of the graduates as were able to attend.

At this time awards were made for successful completion of courses of study in other departments than the eighth grade. Promotional certificates, writing certificates, and all due credit was given girls of lower grades, and many students of the commercial classes received certificates and pins for completed prescribed studies in shorthand, typing and bookkeeping.

The graduation day with its music, flowers, pretty dresses, and complimentary speeches has proven not only to be a great satisfaction to the recipients of diplomas and awards but also arouses other girls who have become disinterested in school work to try to do something in an educational way while the opportunity is at hand.

The effort which the girls make in the school room under the guidance of understanding and well qualified teachers results not only in an increased fund of information but presents a great opportunity for character development through the cultivation of habits of self control, concentration, neatness, promptness, quiet order and square dealing.

After school hours all girls permitted to do so have gymnasium work, or go to the playgrounds and participate in games—tennis or baseball.

The course in the gymnasium work consists of esthetic dancing and instruction in drills, and exercises with dumb-bells, Indian clubs and wands.

This period of exercise and relaxation is enjoyed by the girls, and the result of the work as demonstrated at May Day fetes reflects great credit upon the teacher's ability as well as the girls' interest in the work.

Religious education is characterized by two distinct methods for both Protestant and Catholic girls:

First, instruction by volunteer workers to voluntary groups within the school. With the Roman Catholic girls instruction is given in catechism by a Catholic matron to all Catholic girls who wish to prepare for confirmation. For the Protestant girls Sunday school convenes in the auditorium every Sunday morning at 10 o'clock. The international series of lessons is used as a basis for instruction, but the service is first of all a means of self-expression that has been found very stimulating to character development. Each cottage in turn is responsible for the devotional service, as well as for the decorating of the auditorium. Special musical features are a part of each program. Every cottage has a part in each service. There are no groups of classes, but the teacher in charge interprets the subject matter of the international lesson as it applies to character development of the group at hand. The programs are occasionally varied by talks from the superintendent, the parole officer, or special visitors. Dr. Coffey, of the Department of Public Welfare, delivered an address at one of these sessions that was an inspiration to both faculty and pupils.

The second method of instruction is the service conducted by local ministers on Sunday afternoon. Grateful acknowledgment is hereby given to Rev. F. L. Masseck of Santa Paula, who has contributed his services on the second Sunday of each month for the past eight years. Rev. Masseck is beloved of every girl in the school. He has performed many wedding ceremonies for girls who have left the school, and treasures as one of his choicest experiences an invitation to stand up with the contracting parties at the wedding of a Catholic girl in a Catholic church.

Other ministers who have contributed regularly of their services are the Revs. Trotter, Strickland, Middlemas, Hammond, and Jenkins, of Ventura; Rev. Huebner and Rev. Von der Au, of Oxnard; Rev. Theiss, of Santa Barbara; Rev. Murdock, of Ojai, and others.

For the Roman Catholic girls mass is said every Sunday morning by a priest from the Ventura Mission, while the sisters from the Holy Cross School, Ventura, contribute their services of Sunday school instruction every Sunday afternoon.

During the summer months all chapel services are discontinued and musical programs are rendered instead. These musicales are also voluntary contributions, chiefly from local talent, and acknowledgment is gratefully made to Karl Zaph, violinist, Ventura; members of the choir of First M. E. Church; Mr. and Mrs. J. E. Ruenitz, of Santa Paula; Council of Catholic Women of Ventura County; Oliver Reardon, pianist, Ventura; various other groups from Oxnard, Saticoy, and Harriet Hegstad, mezzo soprano, Los Angeles, who has not only contributed concerts on various occasions, but as a crowning event brought the Girls' Glee Club of University of California at Los Angeles, for an afternoon program.

A series of interesting travel talks was given by Miss Leila Taylor, Red Cross nurse of Ventura, who illustrated her lectures with colored pictures projected by means of a mirroscope. Many interesting costumes and souvenirs were also exhibited by Miss Taylor in these interesting and instructive hours.

Number of Protestants entering during biennium	149
Number of Catholics entering during biennium	69
Number of Jewish faith entering during biennium	2

The results of the parole work, on the whole, have been very satisfactory during the biennium.

Since September 1, 1927, there have been two full-time workers handling this department. Up to the above date this school had a full-time worker in the south, and a half-time worker in the north.

The policy of placing all girls in homes when they are entitled to leave the school has been followed. Sometimes the girl's own home can be used, and in other cases the placement is made in the home of a reputable family. This arrangement gives the best possible means of supervision, and gives many girls insight into normal, happy home life.

Some girls attend full-time school, some part-time, and others remain in the homes as full-time workers. The wages range from $15 per month for school girls, to $40 per month for older girls.

If a girl desires to do work outside of the home, she must first indicate that she can conduct herself properly in the home. When such stability of character has been developed that she can go back and forth down town, contact the public at large, and behave herself as she should, then it is time to plan for work outside of the home.

Many girls marry while on parole. Consent of the school is usually obtained, after something is known of the young man in question. During the biennium 120 girls were married. Many of these girls are mothers at present, and making successful housewives.

Recommendations for release of girls are not made to the Director of Institutions until the superintendent feels that those recommended are sufficiently well established in society to be able to live as self-respecting, law abiding citizens. The married girls form the largest group for which releases are requested, as they seem to become so much

interested in their homes that they have no time nor desire for any diversion other than that which surrounds their married life.

The following figures may give some idea of the amount of work necessary to successfully operate the parole system of the school. These figures do not include the time of the superintendent's office in letter writing, planning the girls' careers and assisting in adjusting matters of a more serious nature. Neither does it include the many small but time consuming tasks which the parole officers perform that can not be classified.

Total number of girls on parole during the first year of the biennium 242, with an increase to 264 the second year.

Calls on parole girls and incident thereto	8,008
Letters received and written	5,479
Callers at office	519
Shopping trips with girls (south only reported)	199
To dentist, doctor and optician with girls (south only reported)	122

Much credit is due the parole supervisors, Mrs. Alice Weed, Los Angeles, and Mrs. Mabel Mitchel, of Berkeley, for their patience and tact in handling the girls on parole. The real work done by these women is the adjusting of difficulties which are continually arising between girl and employer, girl and relatives, and the settling of innumerable matters which come to attention in the daily routine work.

The success of the parole work all depends upon keeping the girls happy and contented in the environment in which they are placed, and at the same time encouraging them to develop habits of self-respect and uprightness so that they may become worth while women who can take their places successfully in society and ultimately fulfill the aim and object embodied in the act creating the Ventura School for Girls.

Respectfully submitted.

Olive P. Walton,
Superintendent.

MOVEMENT OF POPULATION FOR YEAR ENDING JUNE 30, 1927

Statement of Actual Population in Institution

In institution at midnight June 30, 1926		172
Received during year July 1, 1926, to June 30, 1927:		
By new commitments	107	
By return from parole	12	
By return from furlough	8	
By return from escape	6	
Total received		133
In institution during the year		305
Passed out during the year:		
By expiration of commitment	1	
By parole	100	
By furlough	17	
By escape	8	
By transfer	6	
By release by court	17	
By deportation out of state	2	
Total passed out		151
Total population at end of year		154

Statement of Paroles

On parole at midnight June 30, 1926	136	
Paroled during the year	100	
Transferred from furlough to parole	6	
Total on parole during year		242
Term expired on parole	29	
Released by Department of Institutions	29	
Released by court	2	
Returned to school	12	
Transferred to other institution	2	
Died on parole	1	
Total		75
On parole at end of year		167

Statement of Furloughs

On furlough at midnight June 30, 1926	4	
Furloughed during the year	17	
Total on furlough during the year		21
Term expired on furlough	2	
Returned to school from furlough	8	
Transferred from furlough to parole	6	
Released by court from furlough	3	
Transferred to other institution	1	
Released by Department of Institutions	1	
Total		21
On furlough at end of year		0

MOVEMENT OF POPULATION FOR YEAR ENDING JUNE 30, 1928

Statement of Actual Population in Institution

In institution at midnight June 30, 1927		154
Received during year July 1, 1927, to June 30, 1928:		
By new commitments	113	
By return from parole	14	
By return from furlough	3	
By return from escape	12	
Total number received		142
In institution during the year		296

Passed out during the year:		
By expiration of term	1	
By parole	97	
By furlough	8	
By escape	13	
By return to court	1	
By release by court	6	
Total passed out		126
Total population at end of year		170

Statement of Paroles

On parole at midnight June 30, 1927	167	
Paroled during the year	97	
Total on parole during the year		264
Expiration of term on parole	14	
Released by Department of Institutions	74	
Released by court	3	
Returned to school	14	
Total		105
On parole at end of year		159

Statement of Furloughs

On furlough at midnight June 30, 1927	0	
Furloughed during the year	8	
Transferred from escape to furlough	1	
Total on furlough during year		9
Term expired on furlough	2	
Returned to school	3	
Released by court	2	
Transferred to other institution	1	
Total		8
On furlough at end of year		1

REPORT OF SUPERINTENDENT OF THE INDUSTRIAL HOME FOR ADULT BLIND

MR. EARL E. JENSEN,
Director of Institutions,
Sacramento, California.

DEAR SIR: I have the honor to submit the following report of the Industrial Home for the Adult Blind covering the biennial period ending June 30, 1928.

The average attendance of inmates during the time under review was 127; about 80 per cent of these are employed in the shops, or in the sale of products, but many, on account of advanced age or infirmity, produce but little. The output of the industrial department for the two years was as follows:

Brooms	184,827
Whisks and toy brooms	49,472
Baskets, etc.	6,558
Weaving, yards	233
Mattresses	39
Chairs recaned	2,641

The sales amounted to $109,350.95.

The blind workers were paid $31,789.69 in wages.

All expense connected with the shops for material and salaries (with the exception of the clerical work) was paid out of the proceeds and a profit of $9.170.18 made.

With the completion of the new shop building it will be possible to increase the output of the industries now being carried on and also to establish additional activities. However, to make proper use of the facilities now secured for the training of the blind, provision will have to be made so that those of suitable age and desirous of training can be admitted.

It was with this idea in mind of providing opportunity for training those capable of profiting by instruction that the appropriation for the workshop was secured. For when it is considered that the average age of the blind now in the Home is almost sixty years it is evident that the great majority have passed the period when they can be retrained to perform any kind of handicraft so as to become of economic value to themselves or the community. If provision is made for the aged indigent blind as has been suggested, either in an institution or by providing an adequate allowance by the state or counties for maintenance, I believe that the accommodations at the Home are sufficient at the present time to alleviate very materially the situation regarding those in need of training, if the scope of the Department of Field Work is sufficiently expanded.

The most important advance in the cause of the blind made in California during recent years was the organization of the Department of Field Work as an extension of the work of the institution. At present there are only two teachers engaged in this. Their duties are to visit the blind in their own homes to instruct them in industrial and occupational work and render any service that will improve their condition.

During the past year these field workers have made 1350 calls on the blind, given 876 lessons in various handicrafts, and have had an average of 70 pupils under instruction. Through their efforts some blind have been established in business, sales of articles manufactured by the blind have been held, financial help secured and conditions bettered in many ways.

The chief value derived from the activity is that it furnishes occupation which results in some financial gain, thus tending to bring contentment to the blind, consequently making them more acceptable in the family circle and less likely to become a charge on the community.

I wish to express appreciation of the kindness of those friends who have given their services in reading to the blind and assisting them in many other ways. Special thanks are due to Dr. H. Kohlmoos who, for years, has given advice and treatment to all in need of the services of an oculist. Thanks are also due to all those officers, employees and inmates who have worked loyally in the interest of the institution.

Respectfully submitted.

DOUGLAS KEITH,
Superintendent.

NOTE.—Douglas Keith resigned as Superintendent of the Industrial Home for the Adult Blind on September 1, 1928. Mr. Fred F. Bebergall was appointed Superintendent of the Home on September 1, 1928.

STATE NARCOTIC HOSPITAL

The legislature at its 1927 session enacted a law (chapter 89, Statutes of 1927) empowering the Director of Institutions to establish a State Narcotic Hospital for the care, treatment and rehabilitation of persons addicted to the use of narcotic drugs.

Under authority of the above act it has been decided to establish such an institution on state property, known as the Pacific Lodge property, Spadra, California. As the legislature made no provision for funds, an emergency appropriation was necessary and $100,000 has been set aside from the general emergency fund of the state for this purpose.

Alteration of existing buildings has already been undertaken, as well as new construction and improvements which will enable the opening of this unit during the month of July, 1928.

Methods of care and treatment have been exhaustively studied and the necessary personnel is available for the opening of the institution.

The capacity of this institution on opening will be for fifty patients. Provision will be made in January of 1929 for an additional fifty patients.

All persons suffering from drug addiction who want scientific care, treatment and rehabilitation will be accepted. This work has the interest of the public and we are assured of the cooperation of our courts.

Inmates will be required, as provided by law, to remain in the institution for an indeterminate period of from eight months to two years. During their stay they will be given the best of scientific care and treatment, as well as vocational training where needed.

Placement, at the expiration of term of confinement, in some established employment with organized care and supervision are expected to effect a total rehabilitation in the majority of cases.

It is believed that California is the first state to attempt the experiment of establishing an institution of this nature for the care, treatment and ultimate rehabilitation of drug addicts.

INDUSTRIAL FARM FOR WOMEN

This institution no longer exists, in fact, having been abandoned on June 30, 1923. However, the statute creating the farm still remains a law and the property upon which the farm was situated is still held by the state.

The Sonoma State Home (Home for Feeble-minded) has been permitted to occupy the property for the past four years, where a colony of male epileptic patients has been established.

This has been a very successful venture, permitting of a partial segregation of this type, with an opportunity for closer observation and study.

If it should develop that the state does not require this property for the future reestablishment of an Industrial Farm for Women, or for some other similar purpose, it is proposed that the statute creating the farm be revoked and the property be taken over by the Sonoma State Home for a more extensive colonization of epileptics.

APPENDIX

STATISTICS OF STATE INSTITUTIONS UNDER JURISDICTION OF DEPARTMENT OF INSTITUTIONS

STATEMENTS OF REVENUE AND EXPENDITURES, ETC.

STERILIZATION IN CALIFORNIA INSTITUTIONS

The law permitting sterilization in California state institutions was first passed by the Legislature in April, 1909, this original law having been changed in June, 1913, and amended in May, 1917, to read as follows:

STERILIZATION LAW

Approved May 12, 1917. In effect July 27, 1917.

The people of the State of California do enact as follows:

SECTION 1. Section 1 of the act entitled "An act to provide for the asexualization of inmates of state hospitals for the insane, the Sonoma State Home, of convicts in the state prisons, and of idiots, and repealing an act entitled 'An act to permit asexualization of inmates of the state hospitals and the California Home for the Care and Training of Feeble-Minded Children, and of convicts in the state prisons,' approved April 26, 1909," approved June 13, 1913, is hereby amended to read as follows:

Section 1. Before any person who has been lawfully committed to any such hospital for the insane, or who has been an inmate of the Sonoma State Home and who is afflicted with mental disease which may have been inherited and is likely to be transmitted to descendants, the various grades of feeble-mindedness, those suffering from perversion or marked departures from normal mentality or from disease of a syphilitic nature, shall be released or discharged therefrom, the state commission in lunacy may in its discretion, after a careful investigation of all the circumstances of the case, cause such person to be asexualized, and such asexualization whether with or without the consent of the patient shall be lawful and shall not render the said commission, its members or any person participating in the operation liable either civilly or criminally.

SEC. 2. Whenever in the opinion of the resident physician of any state prison it will be beneficial and conducive to the benefit of the physical, mental or moral condition of any recidivist lawfully confined in such state prison, to be asexualized, then such physician shall call in consultation the general superintendent of state hospitals and the secretary of the state board of health, and they shall jointly examine into the particulars of the case with the said resident physician, and if in their opinion or in the opinion of any two of them, asexualization will be beneficial to such recidivist, they may perform the same; *provided,* that such operation shall not be performed unless the said recidivist has been committed to a state prison in this or some other state or country at least two times for rape, assault with intent to commit rape, or seduction, or at least three times for any other crime or crimes, and shall have given evidence while an inmate of a state prison in this state that he is a moral or sexual degenerate or pervert; *and provided, further,* that in the case of convicts sentenced to the state prison for life, who exhibit continued evidence of moral and sexual depravity, the right to asexualize them as provided in this section, shall apply whether they have been inmates of a state prison in this or any other country or state more than one time or not; *provided, further,* that nothing in this act shall apply to or refer to any voluntary patient confined or kept in any state hospital of this state.

SEC. 3. Any idiot, if a minor, may be asexualized by or under the direction of the medical superintendent of any state hospital with the written consent of his or her parent or guardian, and if an adult, then with the written consent of his or her lawfully appointed guardian, and upon the written request of the parent or guardian of any such idiot or fool, the superintendent of any state hospital shall perform such operation or cause the same to be performed without charge therefor.

SEC. 4. An act entitled "An act to permit asexualization of inmates of the state hospitals and the California Home for the Care and Training of Feeble-Minded

Children, and of convicts in the state prison," approved April 26, 1909, is hereby repealed.

The Penal Code of the State of California also provides as follows:

Statutes 1923, Chapter 224

An act to add a new section to the Penal Code to be numbered six hundred forty-five, relating to prevention of procreation of persons convicted of carnal abuse of females under the age of ten years.

(Approved May 25, 1923)

SECTION 1. A new section is hereby added to the Penal Code to be numbered six hundred forty-five, and to read as follows:

645. Whenever any person shall be adjudged guilty of carnal abuse of a female person under the age of ten years, the court may, in addition to such other punishment or confinement as may be imposed, direct an operation to be performed upon such person, for the prevention of procreation.

Statement Showing Number of Sterilizations Performed in California State Institutions for the Insane and Feeble-Minded to June 30, 1928

Institution—	*Males*	*Females*	*Total*
Agnews State Hospital	11	148	159
Mendocino State Hospital	112	60	172
Napa State Hospital	162	403	565
Norwalk State Hospital	316	220	536
Patton State Hospital	1213	519	1732
Stockton State Hospital	975	511	1486
*Sonoma State Home	557	867	1424
*Pacific Colony	1	2	3
Totals	3347	2730	6077

*For feeble-minded.

MONTHLY RECEIPTS AT THE SIX STATE HOSPITALS, FROM JULY 1, 1921, TO JUNE 30, 1928

From July 1, 1921, to June 30, 1922

Months	Stockton	Napa	Agnews	Mendocino	Southern California	Norwalk	Totals
1921—July	$5,498 88	$11,139 35	$9,707 02	$16,970 87	$9,046 66	$3,621 89	$55,984 67
August	6,970 25	11,078 19	9,299 15	15,829 45	6,611 36	2,247 10	52,035 50
September	8,419 74	11,092 46	8,705 19	1,388 74	8,967 67	3,078 73	41,652 53
October	5,958 29	12,493 32	8,655 85	2,597 05	7,582 24	2,485 21	39,771 96
November	7,765 01	11,908 86	9,477 34	1,818 38	8,462 04	3,026 56	42,458 19
December	7,446 75	10,542 21	9,253 41	1,797 86	5,761 56	2,380 46	37,182 25
1922—January	7,514 95	11,841 85	10,829 25	7,711 58	11,068 90	2,360 15	51,326 68
February	6,860 75	10,351 43	7,735 21	1,483 81	9,511 55	2,524 61	38,467 36
March	7,216 74	12,332 79	8,860 35	19,068 54	10,032 23	1,867 30	59,377 95
April	8,906 06	12,729 62	10,612 11	23,434 41	10,204 28	2,715 14	68,601 62
May	9,671 68	13,212 97	8,716 37	25,578 88	5,629 20	2,794 17	65,603 27
June	12,165 84	14,274 03	12,582 34	2,551 35	6,927 70	2,522 12	51,023 38
Totals	$94,394 94	$142,997 08	$114,433 59	$120,230 92	$99,805 39	$31,623 44	$603,485 36

From July 1, 1922, to June 30, 1923

Months	Stockton	Napa	Agnews	Mendocino	Southern California	Norwalk	Totals
1922—July	$8,364 45	$11,329 49	$12,186 62	$12,363 09	$10,326 38	$9,379 77	$63,949 80
August	5,975 62	11,535 74	8,775 42	10,573 42	7,854 70	2,595 59	47,310 49
September	8,585 20	10,767 70	9,625 81	10,250 43	5,957 10	3,990 30	49,186 54
October	7,669 98	12,265 27	13,954 04	2,341 63	8,819 55	2,584 55	47,635 02
November	7,326 77	15,711 14	12,699 95	18,832 81	8,012 21	4,282 29	66,865 17
December	7,892 61	12,705 07	8,236 09	2,175 50	7,119 50	3,968 83	42,097 60
1923—January	8,743 68	13,716 11	12,440 53	19,132 26	10,003 24	3,003 35	67,039 17
February	7,505 35	11,863 04	10,011 07	9,532 03	7,632 28	5,428 89	51,972 66
March	6,874 70	10,061 39	12,426 77	9,421 26	10,124 46	5,744 65	54,653 23
April	10,565 15	10,165 75	10,914 48	14,136 90	8,920 42	4,808 74	59,511 44
May	12,961 50	15,154 49	11,535 39	2,393 89	9,709 50	3,870 99	55,625 76
June	9,119 72	12,484 06	5,899 17	6,077 61	8,986 71	5,329 73	47,897 00
Totals	$101,584 73	$147,759 25	$128,715 34	$117,230 83	$103,466 05	$54,987 68	$653,743 88

From July 1, 1923 to June 30, 1924

Months	Stockton	Napa	Agnews	Mendocino	Southern California	Norwalk	Totals
1923—July	$7,367 38	$11,606 74	$15,565 69	$4,955 69	$8,335 07	$3,631 73	$51,462 30
August	7,368 25	11,493 25	12,550 71	1,601 15	8,756 16	2,714 21	44,483 73
September	6,560 32	8,473 71	6,983 41	1,995 13	7,664 86	3,723 26	35,400 69
October	8,748 30	9,401 33	10,553 38	3,159 93	7,832 09	3,697 68	43,392 71
November	6,144 47	13,731 89	8,662 40	2,281 33	7,586 19	2,597 55	41,003 83
December	5,857 28	10,082 95	9,715 49	3,673 09	6,794 43	2,777 96	38,901 20
1924—January	9,151 66	15,306 98	10,697 62	3,222 21	8 668 19	3 644 93	50 691 59
February	8,352 63	8,080 67	7,559 05	3,673 09	7,556 69	3,091 97	38,314 10
March	7,832 11	8,597 16	8,213 35	1,359 61	8,301 12	3,357 43	37,660 78
April	10,897 29	12,304 69	8,917 25	1,327 10	8,541 74	3,127 50	45,115 57
May	9,738 28	8,599 17	7,311 70	1,788 66	7,454 85	2,829 04	37,721 70
June	7,211 30	9,770 36	9,494 06	2,566 63	7,310 91	3,994 52	40,347 78
Totals	$95,229 27	$127,448 90	$116,224 11	$31,603 62	$94,802 30	$39,187 78	$504,495 98

MONTHLY RECEIPTS AT THE SIX STATE HOSPITALS FROM JULY 1, 1921, TO JUNE 30, 1928—Continued

From July 1, 1924, to June 30, 1925

Months	Stockton	Napa	Agnews	Mendocino	Southern California	Norwalk	Totals
1924—July	$7,811 64	$12,230 13	$12,847 63	$2,408 20	$9,245 52	$4,110 55	$48,653 67
August	7,894 27	7,039 58	9,129 50	2,361 38	9,021 74	4,414 13	39,860 60
September	7,873 97	7,592 39	10,166 05	2,057 84	7,923 12	3,567 20	39,180 57
October	9,249 64	13,232 05	10,862 70	2,174 14	8,840 28	3,776 29	48,135 10
November	7,711 58	7,661 18	8,219 99	1,606 86	7,412 80	2,794 95	35,407 36
December	8,533 12	8,410 86	10,035 38	1,393 33	7,466 00	3,449 02	39,287 71
1925—January	9,582 77	13,471 30	10,541 65	2,458 25	9,259 44	3,299 50	48,612 91
February	7,469 46	8,718 53	7,395 51	1,339 72	6,153 67	4,517 65	35,594 54
March	8,825 72	9,351 69	9,749 92	1,597 18	7,294 22	3,331 44	40,150 17
April	9,164 56	11,923 26	10,658 70	1,895 86	6,664 77	3,617 95	43,925 10
May	8,610 67	8,157 48	9,089 96	1,640 00	10,616 72	3,344 34	41,459 17
June	6,941 72	9,384 28	10,405 61	2,239 26	8,494 16	3,444 30	40,909 33
Totals	$99,669 12	$117,172 73	$119,102 60	$23,172 02	$98,392 44	$43,667 32	$501,176 23

From July 1, 1925, to June 30, 1926

Months	Stockton	Napa	Agnews	Mendocino	Southern California	Norwalk	Totals
1925—July	$10,027 74	$11,402 27	$10,167 85	$2,598 83	$12,001 62	$3,132 07	$49,330 38
August	7 897 34	11,122 05	7,852 02	1,818 70	6,651 41	2,835 17	38,176 69
September	7,237 99	8,254 38	10,403 07	1,734 59	7,646 15	4,115 07	39,391 25
October	8,509 34	13,221 58	10,544 66	2,566 79	9,240 51	4,070 55	48,153 43
November	8,139 65	11,782 53	10,309 98	1,657 12	7,885 28	2,659 00	42,433 56
December	7,918 57	9,571 25	10,042 99	1,812 44	6,400 65	3,567 04	39,312 94
1926—January	9,164 69	10,596 87	9,864 57	2,462 86	9,225 91	3,562 57	44,877 47
February	8,429 48	10,477 58	8,632 29	1,978 18	10,130 83	2,732 53	42,380 89
March	9,590 48	11,275 64	9,477 81	1,723 80	7,606 80	3,946 48	43,621 01
April	8,805 74	9,399 93	9,574 85	1,966 42	7,454 19	3,666 75	40,867 88
May	7,570 55	9,312 03	9,298 28	1,526 09	8,657 11	3,619 27	39,983 33
June	8,635 28	13,969 25	10,314 88	1,614 54	11,500 35	3,928 89	49,963 19
Totals	$101,926 85	$130,385 36	$116,483 25	$23,460 36	$104,400 81	$41,835 39	$518,492 02

From July 1, 1926, to June 30, 1927

Months	Stockton	Napa	Agnews	Mendocino	Patton	Norwalk	Totals
1926—July	$11,448 05	$12,913 63	$10,853 62	$1,872 97	$11,434 43	$3,235 24	$51,757 94
August	7,527 08	9,054 19	10,416 34	1,247 29	6,841 85	3,065 56	38,152 31
September	7,599 85	9,166 42	9,169 43	1,561 49	6,832 49	6,954 53	41,284 21
October	8,196 80	11,573 40	11,260 26	3,121 77	7,198 71	5,898 51	47,249 45
November	8,145 01	10,180 66	10,362 35	1,411 72	10,253 69	2,935 95	43,289 38
December	8,418 27	9,204 83	9,751 66	1,239 56	7,379 50	3,051 48	39,045 30
1927—January	8,700 75	11,471 60	10,794 18	3,047 32	7,295 11	4,063 68	45,372 64
February	8,365 86	9,510 02	10,303 66	1,016 34	11,366 54	3,060 51	43,622 93
March	10,690 91	12,266 05	10,458 80	2,251 26	7,924 70	4,607 44	48,199 16
April	8,441 52	10,043 01	10,134 79	2,327 50	10,244 30	4,250 23	45,441 35
May	10,874 90	10,490 11	9,390 99	951 30	11,284 03	3,652 50	46,643 83
June	8,126 57	11,156 28	10,379 90	1,995 45	6,567 98	3,501 98	41,728 16
Totals	$106,535 57	$127,030 20	$123,275 98	$22,043 97	$104,623 33	$48,277 61	$531,786 60

MONTHLY RECEIPTS AT THE SIX STATE HOSPITALS FROM JULY 1, 1921, TO JUNE 30, 1928—Continued

From July 1, 1927, to June 30, 1928

Months	Stockton	Napa	Agnews	Mendocino	Patton	Norwalk	Totals
1927—July	$8,764 74	$12,576 59	$9,532 69	$2,426 55	$11,190 14	$4,732 31	$49,223 02
August	8,554 80	8,644 60	9,686 21	1,699 82	8,676 73	3,849 80	41,111 96
September	7,882 99	8,951 33	10,845 34	1,716 99	7,583 95	2,923 89	39,904 49
October	11,167 46	9,870 68	9,982 58	2,942 22	9,875 81	4,027 52	47,866 27
November	8,049 54	12,828 30	11,781 93	1,455 70	8,379 58	4,405 46	46,900 51
December	8,528 89	10,495 37	10,409 58	1,846 24	6,896 83	4,009 19	42,186 10
1928—January	7,926 40	8,286 91	11,305 68	2,442 91	8,679 80	3,709 48	42,351 18
February	7,750 73	10,081 70	10,956 90	934 25	8,923 59	5,022 87	43,670 04
March	10,221 94	8,648 98	9,497 18	1,802 50	8,082 25	3,322 00	41,574 85
April	8,286 74	10,984 76	10,631 84	4,192 07	7,727 72	3,364 60	45,187 73
May	10,098 88	10,624 51	11,332 80	1,390 85	7,148 82	3,858 22	44,454 08
June	8,027 41	6,977 33	8,703 49	1,912 95	7,212 22	5,123 33	37,956 73
Totals	$105,260 52	$118,971 06	$124,666 22	$24,763 05	$100,377 44	$48,348 67	$522,386 96

RULES AND REGULATIONS FOR PRIVATE INSTITUTIONS

The law governing the establishment, operation, supervision, inspection and licensing of private institutions for the care, custody, or treatment of the insane, alleged insane or other incompetent persons in the state of Califoria was first passed by the legislature in the year 1903. This law has been amended and now stands on the statute books as follows:

CHAPTER 62

An act to amend section two thousand one hundred ninety-six of the Political Code, relating to the care and treatment of mental defectives in private sanitariums.

[Approved by the Governor April 13, 1925.]

The people of the State of California do enact as follows:

SECTION 1. Section 2196 of the Political Code is hereby amended so as to read as follows:

2196. No person, association, or corporation, must establish or keep an institution for the care, custody, or treatment of the insane, alleged insane or other incompetent persons referred to in this act for compensation or hire, without first obtaining a license therefor from the commission, and having paid the license fee herein provided. All licenses issued under the provisions of this section shall expire on the first day of July next succeeding the date of issue, and application for renewal of the license, accompanied by the necessary fee, must be filed with the commission not less than ten days prior to its expiration each year, otherwise it will stand as automatically canceled. Every application for such license must be accompanied by a plan of the premises proposed to be occupied, describing the capacities of the buildings for the uses intended, the extent and location of grounds appurtenant thereto, and the number of patients proposed to be received therein, with such other information, and in such form, as the commission may require. Such application must also be accompanied by the sum of fifty dollars as a license fee, said fee to cover each fiscal year, and in case of the issuance of license on or after the first day of January next succeeding the beginning of the fiscal year said license fee shall be twenty-five dollars for the remainder of the fiscal year. The commission must not grant any such license without first having made an examination of the premises proposed to be licensed. It must be satisfied that they are substantially as described, and are otherwise fit and suitable for the purposes for which they are designed to be used and that such license should be granted. The commission may at any and all times examine and ascertain how far a licensed institution is conducted in compliance with the license therefor, and after due notice to the institution, and opportunity for it to be heard, the commission, having made a record of the proceedings upon such hearing, may, if the interest of the inmates of the institution so demand, for just and reasonable cause then appearing, and to be stated in its order, amend or revoke any such license by an order to take effect within such time after the service thereof upon the licensee, as the commission determines. The authorities of each institution for insane persons or other incompetents must place on file in the office of the institution the recommendations made by the commissioners as a result of their visits, for the purpose of consultation by such authorities, and for reference by the commissioners upon their visits. Every private institution for the care and treatment of insane or other incompetent persons referred to in this chapter shall keep records of every person admitted thereto, in the same manner and form prescribed for state hospitals, and shall furnish to the commission when required the facts mentioned in subdivision seven of section 2142. The commission or any member thereof may at such times as such commission or commissioners choose visit and examine any hospital or institution caring for and treating insane,

alleged insane, or incompetent persons. In making such visits or examination, said commission or any member thereof shall exercise the same powers as are conferred on them by section 2143 of this chapter. If any person or persons shall carry on or conduct or attempt to carry on or conduct an institution for the care or treatment, or for the care and treatment of the insane or alleged insane, or incompetents without first obtaining a license from the state commission in lunacy, as in this chapter provided, such person or persons shall be deemed guilty of a misdemeanor for each violation of the provisions of this section, and on conviction thereof shall be punished by imprisonment in a county jail not exceeding six months or by a fine not exceeding one thousand dollars, or by both such fine and imprisonment. The managing and executive officers of any corporation violating the provisions of this section shall be liable under the provisions of this section in the same manner and to the same effect as a private individual violating the same.

REGULATIONS FOR THE ESTABLISHMENT, LICENSING AND MAINTENANCE OF PRIVATE INSTITUTIONS FOR THE CARE OF MENTAL PATIENTS

The following requirements have been approved by the Department of Institutions and must be complied with by all persons, associations, or corporations wishing to establish and maintain an institution for the care, custody, and treatment of mental patients for compensation or hire in the state of California.

The Department may refuse a license to an institution or revoke a license previously granted in the event that these regulations have not been complied with, or if, in the opinion of the Department, the standard of care or the equipment or the personnel of the institution is not satisfactory.

1. An application for a license, as required by law, must be filed in the form provided by the Department of Institutions.

2. The application must be accompanied by a block plan showing the extent of the property, location and plans of all existing buildings, together with plans and specifications of all buildings to be erected, a description of the method of sewage disposal, water supply system, etc., in the form prescribed by the Department.

3. The fire protection of the institution must meet with the approval of the fire department of the county. All city and county ordinances relating to institutions must be complied with.

4. The sanitation and hygiene of the institution shall meet the requirements of state and local departments of health.

5. The provisions of the insanity law regarding private institutions for the care of mental patients must be strictly complied with.

6. The institution must secure the services of a well-qualified physician whose appointment shall be approved in writing by the Department. He shall assume personal responsibility for the care and treatment of all patients in the institution. He will be designated as Physician in Charge, and shall have had three years of actual experience as a physician in an institution for the care and treatment of mental patients.

7. The nursing service shall be adequate to care for the patients under treatment in the institution in accordance with modern standards. The head nurse of an institution shall be a graduate of a general hospital training school for nurses, or she shall be a person who has had at least two years' experience and practical training in the care of mental patients in a mental hospital, but preferably she shall be a person possessing both these qualifications.

8. The institution must be inspected and approved by the Department before a license can be granted.

9. Case records of all patients shall be kept in good order, readily acessible to a legally authorized medical or other representative of the Department of Institutions, and shall contain the following:

a. Manner in which patient was admitted, i.e., voluntary, committed, paroled, or by authority of guardian of person.

b. Clinical record of the patient on admission, including case history, physical examination, and mental examination.

c. Statistical data sheet provided by the Department.

d. Notes of the progress of each case, as follows: During the first month following patient's admission, at least once each week; during the remainder of the first year following patient's admission, at least once each month; during subsequent

years, at least once every three months. In addition to such case notes, any special incident of importance, such as accident to patient, injury, suicidal attempt, absence without leave, etc., shall be made a matter of special record at the time of its occurrence.

e. The original orders for restraint issued by the physician shall be written into the respective case records.

f. All physicians' prescriptions shall be made a matter of record.

g. A closing note at time of discharge or death.

10. All suicidal or homicidal attempts, absences without leave, accidents and injuries to patients, and sudden changes in patients' condition shall be reported at once to the physician in charge.

11. An annual report shall be made to the Department of Institutions by the physician in charge, on forms provided by the Department.

12. Restraint is to be employed only in specially indicated cases on the signed order of the physician in charge of the case, or his assistant, or in emergencies, as defined in the succeeding paragraphs.

13. The only forms of mechanical restraint permissible are the camisole, restraining sheet, bow belt, and any other device which has been submitted to the Department, and the use of which has been approved in writing by the same.

14. The physician in charge of the case shall be responsible for the humane character of the restraint, or seclusion, and the duration of their use.

15. In the event that a patient in an institution becomes suddenly disturbed and through such disturbed condition a serious menace to himself or others, and if in such case it should prove impossible for the person in charge to promptly communicate with the physician in charge, the person in charge shall have the right to apply restraint without a physician's order and without a physician being present. In the meantime, it shall be the duty of the person in charge to persist in an effort to communicate with the physician in charge or his assistant physician, and to endeavor to make arrangements leading toward the removal of the restraint.

16. A private institution equipped for the care of mild mental cases, and not possessing adequate hydrotherapeutic facilities for the treatment of disturbed patients, shall make arrangements for the transfer of patients who become disturbed to a state hospital or to another institution adequately equipped for such purposes.

17. A patient shall be considered in seclusion when in a room alone with the door closed which the patient can not open from within.

18. The period of continuous seclusion shall be reduced to the minimum in the best judgment of the attending physician, and the patient shall be observed at least every half hour in the day time. Every effort shall be made to have every patient out of doors daily for a period of exercise. In the absence of any special contra-indications, every patient shall be out of doors for a minimum daily period of four hours.

19. The Department offers the suggestion that seclusion is especially contra-indicated in the case of a patient known to be suicidal, and that it should be avoided in the case of a patient who wets and soils himself.

20. Any employee who strikes or otherwise abuses a patient under any circumstances shall be immediately dismissed from the institution, and such action shall be promptly and fully reported in writing to the Department. An employee so dismissed shall not be reemployed by any institution without the approval in writing of the Department.

These rules and regulations were submitted to the Department of Institutions and adopted as the official rules and regulations for the purposes stated.

The above rules and regulations for the establishment, licensing and maintenance of private institutions for the care of mental patients have been approved by the Department of Institutions. All such institutions now licensed by the Department of Institutions in conformity with the provisions of the above quoted act, and all such institutions that may hereafter be so licensed, must adhere strictly to these rules and regulations. Strict conformity to these rules and regulations shall be the basis upon which license will be renewed and the ability to conform thereto shall be the determining factor upon which license shall be originally granted.

EARL E. JENSEN,
Director of Institutions.

Attest:
LEROY R. BRUCE,
Secretary, Department of Institutions.

List of Private Institutions Licensed by the Department of Institutions to Care for Mental Cases, for the Year Ending June 30, 1928

Name of institution and location—	*Capacity*
Alameda Convalescent Home, 9 N. Morrison avenue, San Jose	10
Alhambra Sanatorium, Inc., 2007 Wilshire boulevard, Los Angeles	12
Alexander Sanitarium, Inc., Belmont, California	45
Anderson Sanatorium, 2535 24th avenue, Oakland	20
Baldy View Sanitarium, 701 Hill drive, San Gabriel	40
Banksia Place Sanitarium, 5227 Santa Monica boulevard, Los Angeles	15
Beale Convalescent Home, 1070 Lincoln avenue, San Jose	6
Carter's Sanitarium, 3133 Mountain View drive, San Diego	6
Casa Del Mar Sanitarium, 11929 Venice boulevard, Los Angeles	95
The Cedars, Ross	36
Century Rest Home, 5055 Novgorod street, Los Angeles	38
Clark's Sanatorium, Box 297, Stockton	75
Compton Sanitarium, Compton	115
El Repose Sanitarium, 222 Chapel street, Berkeley	40
Fernwold Sanitarium, 4440 Ambrose avenue, Los Angeles	12
Valerie Fontielle's Private Home, 330 21st avenue, San Francisco	3
Grande Vista Sanatorium, Route 1, Box 266, Richmond	14
The Greer Home, Inc., 6000 Fulton street, San Francisco	25
Dr. Hansen's Sanitarium, Route 1, Box 129, Artesia	20
Ingleside Rest Home, Wilmar	50
Joslin Sanatorium, R. F. D. 3-A, Lincoln	12
Kimball Sanitarium, La Crescenta, Los Angeles	18
The Livermore Sanitarium, P. O. Box "S," Livermore	85
Los Angeles Sanitarium, 726 East Adams street, Los Angeles	9
Los Cerritos Sanitarium, 4005 American avenue, Long Beach	12
Merrill Osteopathic Sanitarium, 607 Edwards-Wildey Bldg., Los Angeles	40
Mission Rest Home, 1011 S. San Fernando boulevard, Glendale	50
Mountain View Rest Home, 844 Wildrose avenue, Monrovia	40
Nerve Rest Sanitarium, P. O. Box 5, Belmont	25
Palm Grove Sanatorium, Box 425, Monrovia	35
Palm Lodge, 1085 Santa Clara street, Santa Clara	10
Park Sanitarium, 1500 Page street, San Francisco	38
Park West Sanitarium, 601 Steiner street, San Francisco	25
Pasadena Sanitarium, Box 145, South Pasadena	100
Mrs. Peterson's Sanitarium, 3645 41st street, San Diego	12
Pine Grove Sanitarium, Pacific Grove	9
Resthaven, 765 College street, Los Angeles	40
Rock Haven Rest Home, Verdugo City	30
Rosemary Sanitarium, Box 98, Fresno	25
Rosemead Lodge, Rosemead	18
Ross General Hospital, Ross, Marin County	4
Santa Monica Rest Home, 2828 Pico boulevard, Santa Monica	32
Southern California Sanitarium, 2900 Blanche street, Pasadena	70
St. Erne Sanitarium, Culver City	40
St. Helena Sanitarium, Sanitarium	140
Tapley Sanitarium, 9921 National boulevard, Los Angeles	18
Twin Pines, Inc., Belmont	20
Van Vliet's Private Home, 1634 Loma Vista street, Pasadena	2
Villa Shaw Rest Home, 657 W. Milford street, Glendale	25

EXPENDITURE AND REVENUE STATEMENT WITH PER CAPITA COSTS, SEVENTY-EIGHTH AND SEVENTY-NINTH FISCAL YEARS

Department of Institutions

	78th fiscal year	79th fiscal year	78th and 79th fiscal years
Expenditures for support	$49,564 86	$31,682 61	$81,247 47
Expenditures for salaries	16,407 41	25,005 32	41,412 73
Total maintenance expenditures	$65,972 27	$56,687 93	$122,660 20
Expenditures for additions and betterments			
Grand total, all expenditures	$65,972 27	$56,687 93	$122,660 20
Revenue	$9,990 65	$9,019 66	$19,010 31
Net expenditures for maintenance	55,981 62	47,668 27	103,649 89

Agnews State Hospital

Expenditures for support	$300,855 79	$314,713 64	$615,569 43
Expenditures for salaries	220,052 03	226,979 14	447,031 17
Total maintenance expenditures	$520,907 82	$541,692 78	$1,062,600 60
Expenditures for additions and betterments	74,350 52	207,543 63	281,894 15
Grand total, all expenditures	$595,258 34	$749,236 41	$1,344,494 75
Revenue	$121,795 66	$129,600 96	$251,396 62
Net expenditures for maintenance	399,112 16	412,091 82	811,203 98
Inmate population	1,884	1,951	1,917.5
Gross maintenance per capita cost	$276 49	$277 65	$554 16
Net maintenance per capita cost	211 84	211 22	423 05

Mendocino State Hospital

Expenditures for support	$153,686 26	$179,830 91	$333,517 17
Expenditures for salaries	175,594 75	181,445 63	357,040 38
Total maintenance expenditures	$329,281 01	$361,276 54	$690,557 55
Expenditures for additions and betterments	122,759 75	263,711 32	386,471 07
Grand total, all expenditures	$452,040 76	$624,987 86	$1,077,028 62
Revenue	$24,157 11	$24,061 92	$48,219 03
Net expenditures for maintenance	305,123 90	337,214 62	642,338 52
Inmate population	1,160	1,229	1,194.5
Gross maintenance per capita cost	$283 86	$293 96	$578 11
Net maintenance per capita cost	263 04	274 38	537 75

Napa State Hospital

Expenditures for support	$306,599 43	$327,592 80	$634,192 23
Expenditures for salaries	326,588 31	323,759 06	650,347 37
Total maintenance expenditures	$633,187 74	$651,351 86	$1,284,539 60
Expenditures for additions and betterments	9,800 42	91,987 61	101,788 03
Grand total, all expenditures	$642,988 16	$743,339 47	$1,386,327 63
Revenue	$140,465 10	$135,786 88	$276,251 98
Net expenditures for maintenance	492,722 64	515,564 98	1,008,287 62
Inmate population	2,858	2,885	2,871.5
Gross maintenance per capita cost	$221 55	$225 77	$447 34
Net maintenance per capita cost	172 40	178 71	351 14

EXPENDITURE AND REVENUE STATEMENT WITH PER CAPITA COSTS, SEVENTY-EIGHTH AND SEVENTY-NINTH FISCAL YEARS—Continued

Norwalk State Hospital

	78th fiscal year	79th fiscal year	78th and 79th fiscal years
Expenditures for support	$165,414 40	$175,369 29	$340,783 69
Expenditures for salaries	197,215 31	218,419 11	415,634 42
Total maintenance expenditures	$362,629 71	$393,788 40	$756,418 11
Expenditures for additions and betterments	206,623 33	187,770 38	394,393 71
Grand total, all expenditures	$569,253 04	$581,558 78	$1,150,811 82
Revenue	$43,535 45	$51,886 68	$95,422 13
Net expenditures for maintenance	319,094 26	341,901 72	660,995 98
Inmate population	1,391	1,592	1,491.5
Gross maintenance per capita cost	$260 70	$247 35	$507 15
Net maintenance per capita cost	229 40	214 76	443 18

Patton State Hospital

Expenditures for support	$297,024 89	$327,171 48	$624,196 37
Expenditures for salaries	312,455 32	309,424 18	621,879 50
Total maintenance expenditures	$609,480 21	$636,595 66	$1,246,075 87
Expenditures for additions and betterments	56,947 84	146,627 38	203,575 22
Grand total, all expenditures	$666,428 05	$783,223 04	$1,449,651 09
Revenue	$110,774 72	$106,076 78	$216,851 50
Net expenditures for maintenance	498,705 49	530,518 88	1,029,224 37
Inmate population	2,658	2,768	2,713
Gross maintenance per capita cost	$229 30	$229 98	$459 30
Net maintenance per capita cost	187 62	191 66	379 37

Stockton State Hospital

Expenditures for support	$370,025 37	$406,049 40	$776.074 77
Expenditures for salaries	352,859 20	367,613 54	720,472 74
Total maintenance expenditures	$722 884 57	$773,662 94	$1,496,547 51
Expenditures for additions and betterments	100,795 26	170,345 59	271,140 85
Grand total, all expenditures	$823,679 83	$944,008 53	$1,767,688 36
Revenue	$111,818 45	$114,309 11	$226,127 56
Net expenditures for maintenance	611,066 12	659,353 83	1,270,419 95
Inmate population	3,060	3,055	3,057.5
Gross maintenance per capita cost	$236 24	$253 24	$489 48
Net maintenance per capita cost	199 69	215 82	415 51

Sonoma State Home

Expenditures for support	$295,301 53	$306,398 17	$601,699 70
Expenditures for salaries	239,406 83	249,052 02	488,458 85
Total maintenance expenditures	$534,708 36	$555,450 19	$1,090,158 55
Expenditures for additions and betterments	14,536 12	6,654 08	21,190 20
Grand total, all expenditures	$549,244 48	$562,104 27	$1,111,348 75
Revenue	$514,749 13	$536,363 22	$1,051,112 35
Net expenditures for maintenance	19,959 23	19,086 97	39,046 20
Inmate population	2,190	2,262	2,226
Gross maintenance per capita cost	$244 16	$245 56	$489 74
Net maintenance per capita cost	9 11	8 44	17 54

EXPENDITURE AND REVENUE STATEMENT WITH PER CAPITA COSTS, SEVENTY-EIGHTH AND SEVENTY-NINTH FISCAL YEARS—Continued

Pacific Colony

	78th fiscal year	79th fiscal year	78th and 79th fiscal years
Expenditures for support	$14,111 25	$31,680 91	$45,792 16
Expenditures for salaries	11,995 89	35,719 05	47,714 94
Total maintenance expenditures	$26,107 14	$67,399 96	$93,507 10
Expenditures for additions and betterments	165,685 60	228,976 94	394,662 54
Grand total, all expenditures	$191,792 74	$296,376 90	$488,169 64
Revenue	$4,162 84	$29,138 27	$33,601 11
Net expenditures for maintenance	21,944 30	37,961 69	59,905 99
Inmate population*		81	
Gross maintenance per capita cost		$832 10	
Net maintenance per capita cost		468 66	

* Opened in May, 1927.

Preston School of Industry

Expenditures for support	$196,507 42	$217,061 89	$413,569 31
Expenditures for salaries	142,249 45	157,645 32	299,894 77
Total maintenance expenditures	$338,756 87	$374,707 21	$713,464 08
Expenditures for additions and betterments	30,063 75	29,760 61	59,824 36
Grand total, all expenditures	$368,820 62	$404,467 82	$773,288 44
Revenue	$135,090 94	$140,810 33	$275,901 27
Net expenditures for maintenance	203,665 93	233,896 88	437,562 81
Inmate population	564	589	576.5
Gross maintenance per capita cost	$600 63	$636 18	$1,237 58
Net maintenance per capita cost	361 11	397 11	759 00

Whittier State School

Expenditures for support	$110,287 86	$135,036 68	$245,324 54
Expenditures for salaries	108,669 32	117,150 33	225,819 65
Total maintenance expenditures	$218,957 18	$252,187 01	$471,144 19
Expenditures for additions and betterments	33,773 94	22,267 52	56,041 46
Grand total, all expenditures	$252,731 12	$274,454 53	$527,185 65
Revenue	$93,627 38	$89,970 97	$183,598 35
Net expenditures for maintenance	125,329 80	162,216 04	287,545 84
Inmate population	314	302	308
Gross maintenance per capita cost	$697 32	$835 06	$1,529 60
Net maintenance per capita cost	399 14	537 14	933 59

Ventura School for Girls

Expenditures for support	$55,739 07	$55,928 83	$111,667 90
Expenditures for salaries	62,027 89	62,564 60	124,592 49
Total maintenance expenditures	$117,766 96	$118,493 43	$236,260 39
Expenditures for additions and betterments	764 42	27,379 14	28,143 56
Grand total, all expenditures	$118,531 38	$145,872 57	$264,403 95
Revenue	$39,710 98	$38,281 31	$77,992 29
Net expenditures for maintenance	78,055 98	80,212 12	158,268 10
Inmate population	163	160	161.5
Gross maintenance per capita cost	$722 50	$740 58	$1,462 91
Net maintenance per capita cost	478 87	501 33	979 99

EXPENDITURE AND REVENUE STATEMENT WITH PER CAPITA COSTS, SEVENTY-EIGHTH AND SEVENTY-NINTH FISCAL YEARS—Continued

Industrial Home for the Adult Blind—Institution

	78th fiscal year	79th fiscal year	78th and 79th fiscal years
Expenditures for support	$29,455 37	$31,835 71	$61,291 08
Expenditures for salaries	28,414 93	28,940 33	57,355 26
Total maintenance expenditures	$57,870 30	$60,776 04	$118,646 34
Expenditures for additions and betterments	2,429 87	11,199 40	13,629 27
Grand total, all expenditures	$60,300 17	$71,975 44	$132,275 61
Revenue	$7,607 62	$5,376 03	$12,983 65
Net expenditures for maintenance	50,262 68	55,400 01	105,662 69
Inmate population	127	126	126.5
Gross maintenance per capita cost	$455 67	$482 35	$937 92
Net maintenance per capita cost	395 77	439 68	835 28

Industrial Home for the Adult Blind—Factory

Total sales	$56,196 56	$53,154 39	$109,350 95
Total expenses	50,113 58	49,193 73	99,307 31
Net profit (credited to revenue of institution)	$6,082 98	$3,960 66	$10,043 64

Department and All Institutions

Expenditures for support	$2,344,573 50	$2,540,352 32	$4,884,925 82
Expenditures for salaries	2,193,936 64	2,303,717 63	4,497,654 27
Total maintenance expenditures	$4,538,510 14	$4,844,069 95	$9,382,580 09
Expenditures for additions and betterments	818,530 82	1,394,223 60	2,212,754 42
Grand total, all expenditures	$5,357,040 96	$6,238,293 55	$11,595,334 51
Revenue	$1,357,486 03	$1,410,982 12	$2,768,468 15
Net expenditures for maintenance	3,181,024 11	3,433,087 83	6,614,111 94
Inmate population	16,369	17,000	16,675
Gross maintenance per capita cost	$277 26	$284 95	$562 67
Net maintenance per capita cost	194 33	201 95	396 65

Statement of Maintenance Expenditures and Revenue, Seventy-Eighth Fiscal Year

	Population	Expenditures for—		Total maintenance expenditures	Revenue	Net expenditures by state for maintenance
		Support	Salaries			
Department of Institutions		$49,564 86	$16,407 41	$65,972 27	$9,990 65	$55,981 62
Stockton State Hospital	3,060	370,025 37	352,859 20	722,884 57	111,818 45	611,066 12
Napa State Hospital	2,858	306,599 43	326,588 31	633,187 74	140,465 10	492,722 64
Agnews State Hospital	1,884	300,855 79	220,052 03	520,907 82	121,795 66	399,112 16
Mendocino State Hospital	1,160	153,686 26	175,594 75	329,281 01	24,157 11	305,123 90
Patton State Hospital	2,658	297,024 89	312,455 32	609,480 21	110,774 72	498,705 49
Norwalk State Hospital	1,391	165,414 40	197,215 31	362,629 71	43,535 45	319,094 26
Sonoma State Home	2,190	295,301 53	239,406 83	534,708 36	514,749 13	19,959 23
*Pacific Colony		14,111 25	11,995 89	26,107 14	4,162 84	21,944 30
Ventura School for Girls	163	55,739 07	62,027 89	117,766 96	39,710 98	78,055 98
Preston School of Industry	564	196,507 42	142,249 45	338,756 87	135,090 94	203,665 93
Whittier State School	314	110,287 86	108,669 32	218,957 18	93,627 38	125,329 80
Industrial Home for Adult Blind	127	29,455 37	28,414 93	57,870 30	7,607 62	50,262 68
Totals	16,369	$2,344,573 50	$2,193,936 64	$4,538,510 14	$1,357,486 03	$3,181,024 11

* Opened in May, 1927.

Statement of Maintenance Expenditures and Revenue, Seventy-Ninth Fiscal Year

	Population	Expenditures for—		Total maintenance expenditures	Revenue	Net expenditures by state for maintenance
		Support	Salaries			
Department of Institutions		$31,682 61	$25,005 32	$56,687 93	$9,019 66	$47,668 27
Stockton State Hospital	3,055	406,049 40	367,613 54	773,662 94	114,309 11	659,353 83
Napa State Hospital	2,885	327,592 80	323,759 06	651,351 86	135,786 88	515,564 98
Agnews State Hospital	1,951	314,713 64	226,979 14	541,692 78	129,600 96	412,091 82
Mendocino State Hospital	1,229	179,830 91	181,445 63	361,276 54	24,061 92	337,214 62
Patton State Hospital	2,768	327,171 48	309,424 18	636,595 66	106,076 78	530,518 88
Norwalk State Hospital	1,592	175,369 29	218,419 11	393,788 40	51,886 68	341,901 72
Sonoma State Home	2,262	306,398 17	249,052 02	555,450 19	536,363 22	19,086 97
Pacific Colony	81	31,680 91	35,719 05	67,399 96	29,438 27	37,961 69
Ventura School for Girls	160	55,928 83	62,564 60	118,493 43	38,281 31	80,212 12
Preston School of Industry	589	217,061 89	157,645 32	374,707 21	140,810 33	233,896 88
Whittier State School	302	135,036 68	117,150 33	252,187 01	89,970 97	162,216 04
Industrial Home for Adult Blind	126	31,835 71	28,940 33	60,776 04	5,376 03	55,400 01
Totals	17,000	$2,540,352 32	$2,393,717 63	$4,844,069 95	$1,410,982 12	$3,433,087 83

Statement of Maintenance Expenditures and Revenue Seventy-Eighth and Seventy-Ninth Fiscal Years

	Population	Expenditures for—		Total maintenance expenditures	Revenue	Net expenditures by state for maintenance
		Support	Salaries			
Department of Institutions		$81,247 47	$41,412 73	$122,660 20	$19,010 31	$103,649 89
Stockton State Hospital	3,057.5	776,074 77	720,472 74	1,496,547 51	226,127 56	1,270,419 95
Napa State Hospital	2,871.5	634,192 23	650,347 37	1,284,539 60	276,251 98	1,008,287 62
Agnews State Hospital	1,917.5	615,569 43	447,031 17	1,062,600 60	251,396 62	811,203 98
Mendocino State Hospital	1,194.5	333,517 17	357,040 38	690,557 55	48,219 03	642,338 52
Patton State Hospital	2,713	624,196 37	621,879 50	1,246,075 87	216,851 50	1,029,224 37
Norwalk State Hospital	1,491.5	340,783 69	415,634 42	756,418 11	95,422 13	660,995 98
Sonoma State Home	2,226	601,699 70	488,458 85	1,090,158 55	1,051,112 35	39,046 20
Pacific Colony	81	45,792 16	47,714 94	93,507 10	33,601 11	59,905 99
Ventura School for Girls	161.5	111,667 90	124,592 49	236,260 39	77,992 29	158,268 10
Preston School of Industry	576.5	413,569 31	299,894 77	713,464 08	275,901 27	437,562 81
Whittier State School	308	245,324 54	225,819 65	471,144 19	183,598 35	287,545 84
Industrial Home for Adult Blind	126.5	61,291 08	57,355 26	118,646 34	12,983 65	105,662 69
Totals	16,725	$1,884,925 82	$4,497,654 27	$9,382,580 09	$2,768,468 15	$6,614,111 94

Statement of Expenditures and Revenue, Seventy-Eighth Fiscal Year

	Population	Expenditures for—			Total, all expenditures	Revenue	Total net expenditures by state
		Support	Salaries	Additions and betterments			
Department of Institutions		$49,564 86	$16,407 41		$65,972 27	$9,990 65	$55,981 62
Stockton State Hospital	3,060	370,025 37	352,859 20	$100,795 26	823,679 83	111,818 45	711,861 38
Napa State Hospital	2,858	306,599 43	326,588 31	9,800 42	642,988 16	140,465 10	502,523 06
Agnews State Hospital	1,884	300,855 79	220,052 03	74,350 52	595,258 34	121,795 66	473,462 68
Mendocino State Hospital	1,160	153,686 26	175,594 75	122,759 75	452,040 76	24,157 11	427,883 65
Patton State Hospital	2,658	297,024 89	312,455 32	56,947 84	666,428 05	110,774 72	555,653 33
Norwalk State Hospital	1,391	165,414 40	197,215 31	206,623 33	569,253 04	43,535 45	525,717 59
Sonoma State Home	2,190	295,301 53	239,406 83	14,536 12	549,244 48	514,749 13	34,495 35
Pacific Colony		14,111 25	11,995 89	165,685 60	191,792 74	4,162 84	187,629 90
Ventura School for Girls	163	55,739 07	62,027 89	764 42	118,531 38	39,710 98	78,820 40
Preston School of Industry	564	196,507 42	142,249 45	30,063 75	368,820 62	135,090 94	233,729 68
Whittier State School	314	110,287 86	108,669 32	33,773 94	252,731 12	93,627 38	159,103 74
Industrial Home for Adult Blind	127	29,455 37	28,414 93	2,429 87	60,300 17	7,607 62	52,692 55
Totals	16,369	$2,344,573 50	$2,193,936 64	$818,530 82	$5,357,040 96	$1,357,486 03	$3,999,554 93

Statement of Expenditures and Revenue, Seventy-Ninth Fiscal Year

	Population	Expenditures for—			Total, all expenditures	Revenue	Total net expenditures by state
		Support	Salaries	Additions and betterments			
Department of Institutions		$31,682 61	$25,005 32		$56,687 93	$9,019 66	$47,668 27
Stockton State Hospital	3,055	406,049 40	367,613 54	$170,345 59	944,008 53	114,309 11	829,699 42
Napa State Hospital	2,885	327,592 80	323,759 06	91,987 61	743,339 47	135,786 88	607,552 59
Agnews State Hospital	1,951	314,713 64	226,979 14	207,543 63	749,236 41	129,600 96	619,635 45
Mendocino State Hospital	1,229	179,830 91	181,445 63	263,711 32	624,987 86	24,061 92	600,925 94
Patton State Hospital	2,768	327,171 48	309,424 18	146,627 38	783,223 04	106,076 78	677,146 26
Norwalk State Hospital	1,592	175,369 29	218,419 11	187,770 38	581,558 78	51,886 68	529,672 10
Sonoma State Home	2,262	306,398 17	249,052 02	6,654 08	562,104 27	536,363 22	25,741 05
Pacific Colony	81	31,680 91	35,719 05	228,976 94	296,376 90	29,438 27	266,938 63
Ventura School for Girls	160	55,928 83	62,564 60	27,379 14	145,872 57	38,281 31	107,591 26
Preston School of Industry	589	217,061 89	157,645 32	29,760 61	404,467 82	140,810 33	263,657 49
Whittier State School	302	135,036 68	117,150 33	22,267 52	274,454 53	89,970 97	184,483 56
Industrial Home for Adult Blind	126	31,835 71	28,940 33	11,199 40	71,975 44	5,376 03	66,599 41
Totals	17,000	$2,540,352 32	$2,303,717 63	$1,394,223 60	$6,238,293 55	$1,410,982 12	$4,827,311 43

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Statement of Expenditures and Revenue, Seventy-Eighth and Seventy-Ninth Fiscal Years

	Population	Expenditures for—			Total, all expenditures	Revenue	Total net expenditures by state
		Support	Salaries	Additions and betterments			
Department of Institutions		$81,247 47	$41,412 73		$122,660 20	$19,010 31	$103,649 89
Stockton State Hospital	3,057.5	776,074 77	720,472 74	$271,140 85	1,767,688 36	226,127 56	1,541,560 80
Napa State Hospital	2,871.5	634,192 23	650,347 37	101,788 03	1,386,327 63	276,251 98	1,110,075 65
Agnews State Hospital	1,917.5	615,569 43	447,031 17	281,894 15	1,344,494 75	251,396 62	1,093,098 13
Mendocino State Hospital	1,144.5	333,517 17	357,040 38	386,471 07	1,077,028 62	48,219 03	1,028,809 59
Patton State Hospital	2,713	624,196 37	621,879 50	203,575 22	1,449,651 09	216,851 50	1,232,799 59
Norwalk State Hospital	1,491.5	340,783 69	415,634 42	394,393 71	1,150,811 82	95,422 13	1,055,389 69
Sonoma State Home	2,226	601,699 70	488,458 85	21,190 20	1,111,348 75	1,051,112 35	60,236 40
Pacific Colony	81	45,792 16	47,714 94	394,662 54	488,169 64	33,601 11	454,568 53
Ventura School for Girls	161.5	111,667 90	124,592 49	28,143 56	264,403 95	77,992 29	186,411 66
Preston School of Industry	576.5	413,569 31	299,894 77	59,824 36	773,288 44	275,901 27	497,387 17
Whittier State School	308	245,324 51	225,819 65	56,041 46	527,185 65	183,598 35	343,587 30
Industrial Home for Adult Blind	126.5	61,291 08	57,355 26	13,629 27	132,275 61	12,983 65	119,291 96
Totals	16,675	$4,884,925 82	$4,497,654 27	$2,212,754 42	$11,595,334 51	$2,768,468 15	$8,826,866 36

Comparative Statement of Production and Expense of Farming Operations for the Seventy-Eighth Fiscal Year, July 1, 1926, to June 30, 1927

	Agnews	Mendocino	Napa	Norwalk	Patton	Stockton	Sonoma	Preston	Ventura	Whittier
Production—										
Consumed at institution:										
Dairy		$20,441 36	$34,078 61	$23,294 06	$38,684 84	$42,581 58	$34,163 91	$15,299 56	$3,070 45	
Hog ranch	$1,836 30	5,465 83	9,636 27	4,354 91	13,287 61	16,364 06	5,076 98	4,766 89	988 38	$1,544 18
Poultry	8,113 74	13,078 13	9,238 76	3,308 61	9,581 98	7,620 68	12,280 81	3,104 58		
Farm, orchard, vegetable	15,778 37	19,487 80	31,079 50	10,781 06	31,763 97	65,706 08	14,682 13	5,865 98	5,679 26	3,714 16
Miscellaneous		1,596 00		300 00						
Total consumed at institution	$25,728 41	$60,069 12	$84,033 14	$42,038 64	$93,318 40	$132,272 40	$66,203 83	$29,037 01	$9,738 09	$5,258 34
Sales:										
Dairy			$666 72	$7,884 16	$312 64	$1,214 82	$345 22			
Hog ranch	$70 00		264 85			1,659 96				
Poultry			1,579 41				134 05			
Farm, orchard, vegetable	60 40		13 00		2,273 59	2,032 85				$17,312 41
Miscellaneous			20 00				44 00			21 00
Total sales	$130 40		$2,543 98	$7,884 16	$2,586 23	$4,907 63	$523 27			$17,333 41
Cattle, feed, fertilizer, etc.	2,017 01	$11,462 70	15,656 82	13,161 53	15,931 82	29,079 80	3,043 33	$4,471 89		
Total production	$27,875 82	$71,531 82	$102,233 94	$63,084 33	$111,836 45	$166,259 83	$69,770 43	$33,508 90	$9,738 09	$22,591 75
Expense—direct:										
Dairy		$7,195 57	$17,876 73	$13,547 63	$16,646 35	$11,607 65	$14,803 98	$6,867 02	$3,019 21	$901 30
Hog ranch	$1,064 15	1,216 69	1,105 36	840 89	3,123 09	9,186 76	979 10	2,540 31	984 80	
Poultry	7,041 71	7,149 00	4,626 59	2,568 50	6,787 46	6,346 39	9,524 52	3,947 65		
Farm, orchard, vegetable	10,154 01	10,116 34	15,129 61	6,968 58	25,722 04	31,303 33	19,473 88	8,059 25	2,974 19	6,476 98
Stable and tractor	2,486 78	352 48	4,007 38	592 87	2,081 87	4,412 29		4,261 44	660 03	1,117 64
Miscellaneous										1,854 52
Total direct expense	$20,746 65	$26,030 08	$42,745 67	$24,518 47	$54,360 81	$62,856 42	$44,781 48	$25,675 67	$7,638 23	$10,350 44
Maintenance of employees	3,360 00	2,986 29	6,911 68	3,780 00	10,220 00	11,860 00	1,620 00	1,890 00	840 00	1,260 00
Tankage	903 96	557 04	1,361 72	712 92	1,275 60	1,440 00	960 00	270 84	78 25	28 00
Local products consumed in production	819 00	12,359 36	16,999 09	10,639 83	16,088 07	30,076 55	5,470 43	4,471 89		
Total expense	$25,829 61	$41,932 77	$68,018 16	$39,651 22	$81,944 48	$106,232 97	$52,831 91	$32,308 40	$8,556 48	$11,638 44
Increase or decrease in inventories	612 70	[1]79 87	3,033 02	[1]7,111 73	[1]5,131 57	[1]2,019 25	[1]3,527 84	[1]255 63	[1]400,00	500 00
Total cost of production	$26,442 31	$41,852 90	$71,051 18	$32,539 49	$76,812 91	$104,213 72	$49,304 07	$32,052 77	$8,156 48	$12,138 44
Net production value over expense	$1,433 51	$29,678 92	$31,182 76	$30,544 84	$35,023 54	$62,046 11	$20,466 36	$1,456 13	$1,581 61	$10,453 31

Net charge to production of milk	None produced	$11,691 02	$29,414 53	$16,459 92	$26,133 13	$19,167 95	$11,896 50	$8,661 28	$3,149 91	None produced
Total gallons of milk consumed		73,606	122,260	98,920	143,766	120,866	121,367	58,230	11,349	
Cost per gallon for production		15.88c	24.06c	16.63c	18.18c	15.86c	09.80c	14.87c	27.75c	
Net charge to production of eggs	$6,029 89	$4,909 24	$4,970 13	$1,373 19	$5,367 58	$4,701 39	$7,192 37	$4,216 34	None produced	None produced
Total dozen of eggs consumed	20,876	29,746	26,108	8,138½	23,719	19,148	29,947	7,818¾		
Cost per dozen for production	28.88c	16.50c	19.03c	16.87c	22.63c	24.55c	24.02c	53.93c		
Net charge to production of pork	$2,305 61	$3,527 43	$4,092 37	$1,675 19	$2,657 35	$10,761 70	$1,240 70	$2,761 15	$838 05	None produced
Total pounds of pork consumed	10,467	26,955	48,467	22,938	64,350	93,026	27,438	23,301	5,070	
Cost per pound for production	22.03c	13.09c	08.44c	07.30c	04.13c	11.57c	04.52c	11.85c	16.53c	
Local products in quantities—										
Consumed at institution:										
Vegetables consumed or canned, pounds	697,278	767,120	886,425	467,787	1,090,422	2,115,059	272,274	281,345	65,245	55,335
Poultry and rabbits, pounds	4,979	9,381	11,970	2,972	7,262	8,048	8,720	2,115	10,473	
Fruits, consumed or canned, lbs.	32,662	44,891	170,356	4,896	9,655	402,583	303,006	2,959	39,860	54,800
Fruits, dried, pounds		8,928	90,410							
Citrus fruits, pounds				2,227	86,900					
Miscellaneous, pounds									994	
Honey, pounds					900	63				
Beef and veal, etc., (dressed) pounds		10,988	26,179	18,060	13,027	35,723	27,887	6,623	762	
Butter, pounds, (made from above locally produced milk)								6,415		
Consumed in production or sold:										
Fruits and vegetables, lbs.	5,462				56,840	21,264				
Fertilizer, bones, etc., tons	172.5	657.5	12.53	1,097	1,200	2,115	915			
Alfalfa, hay, grains and other feeds, tons	$204 94	$1,101 59 [2]	$1,312 58 [3]	$1,502 63	$1,933 24 [4]	$1,676 16 [5]	$151 50 [6]	$430 73	[7]	[8]
Miscellaneous										

[1] Increase.
[2] 31 lbs. walnuts.
[3] 258 turkeys
[4] 6 hides
[5] 1,531 lbs. wool.
[6] 121 hides.
[7] 871 lbs. walnuts.
[8] 123 lbs. popcorn.

Comparative Statement of Production and Expense of Farming Operations for the Seventy-Ninth Fiscal Year, July 1, 1927, to June 30, 1928

	Agnews	Mendocino	Napa	Norwalk	Patton	Stockton	Pacific Colony	Sonoma	Preston	Ventura	Whittier
Production—											
Consumed at institution:											
Dairy		$19,635 84	$38,037 66	$26,930 33	$41,508 69	$47,163 85	$2,124 96	$37,614 41	$17,410 60	$3,224 42	
Hog ranch	$841 80	5,457 51	5,866 50	7,351 97	11,632 43	16,410 56	219 08	6,563 10	6,682 25	1,033 06	
Poultry	8,996 37	12,468 91	14,242 59	2,788 72	9,674 45	8,541 21	236 00	12,009 30	2,105 31		$175 80
Farm, orchard, vegetable	17,680 21	16,304 51	26,196 37	20,033 13	33,880 12	67,406 42	668 19	10,564 07	7,333 76	4,645 35	2,410 72
Miscellaneous											2,934 88
Total consumed at institutions	$27,518 38	$53,866 77	$84,343 12	$57,104 15	$96,695 69	$139,522 04	$3,248 23	$66,750 88	$33,531 92	$8,902 83	$5,521 40
Sales:											
Dairy			$561 38	$112 72	$391 71	$1,181 80		$312 25			
Hog ranch			313 52			183 88					
Poultry			100 30								
Farm, orchard, vegetable	$5,481 28		80 11			89 26					
Miscellaneous		$911 09		33 53				190 95			
Total sales	$5,481 28	$911 09	$1,055 31	$146 25	$391 71	$1,454 94		$503 20			
Cattle, feed, fertilizer, etc.	3,640 03	13,332 30	19,035 81	10,920 73	16,767 01	26,757 96	$2,299 90	2,336 33	$9,413 01	$488 40	$16,463 10
Total production	$36,639 69	$68,110 16	$104,434 24	$68,171 13	$113,854 41	$167,734 94	$5,548 13	$69,590 41	$42,944 93	$9,391 23	$21,984 50
Expense—direct:											
Dairy		$10,250 82	$20,526 35	$15,405 88	$15,714 56	$14,534 13	$2,008 51	$19,032 91	$8,056 56	$3,641 93	
Hog ranch	$679 67	1,689 13	1,144 92	3,619 70	4,162 31	8,233 18	12 27	3,021 01	3,136 85	2,130 00	
Poultry	8,049 04	7,945 67	7,408 49	3,767 88	7,567 56	6,970 44	121 60	10,141 49	3,536 75	160 00	
Farm, orchard, vegetable	13,129 31	10,878 90	15,469 38	6,081 93	23,371 24	30,458 48	3,625 88	19,243 72	10,504 24	2,400 12	$11,419 97
Stable and tractor	3,696 21	769 65	7,456 45	768 95	2,442 12	4,309 68	508 49		2,518 67	853 87	2,865 35
Total direct expense	$25,554 23	$31,534 17	$52,005 59	$29,644 34	$53,257 79	$64,505 91	$6,276 75	$51,439 13	$27,753 07	$9,185 92	$14,285 32
Maintenance of employees	3,325 00	6,300 00	9,927 23	4,494 00	10,640 00	12,180 00	1,260 00	5,040 00	2,100 00	840 00	1,680 00
Tankage	936 96	637 52	1,383 35	865 32	1,328 88	1,488 00	48 00	960 00	282 60	76 80	
Local products consumed in production	1,119 10	10,370 58	18,691 33	11,406 21	16,868 36	25,635 90	799 90	4,183 99	9,413 01		
Total expense	$30,935 29	$48,842 27	$82,007 50	$46,409 87	$82,095 03	$103,809 81	$8,384 65	$61,623 12	$39,548 68	$10,102 72	$15,965 32
Increase or decrease in inventories	[1]1,154 50	[1]854 20	[1]3,074 78	[1]2,000 18	[1]2,668 17	453 95	[1]978 50	3,648 47	[1]3,416 01	[1]240 00	
Total cost, production	$29,780 79	$47,988 07	$78,543 72	$44,409 69	$79,426 86	$104,263 76	$7,406 15	$65,271 59	$36,132 67	$9,862 72	$15,965 32
Net production value over expense	$6,858 90	$20,122 09	$25,501 52	$23,761 44	$34,427 55	$63,471 18	[1]$1,858 02	$4,318 82	$6,812 26	[1]$471 49	$6,019 18

Net charge to production of milk	None produced	$12,437 54	$31,430 37	$20,581 19	$30,676 73	$19,651 49	$1,881 49	$17,724 79	$9,955 94	$3,548 29	None produced
Total gallons of milk consumed		71,043	138,695	100,403	162,216	158,686	8,445	127,636	62,747	12,147	
Cost per gallon for production		17.51c	22.66c	20.49c	18.91c	12.38c	22.14c	13.89c	15.87c	29.21c	
Net charge to production of eggs	$7,581 43	$8,820 05	$7,191 26	$3,427 82	$5,913 24	$7,722 81	$85 78	$6,601 34	$4,649 12	None produced	None produced
Total dozen of eggs consumed	29,829	36,258	35,906	7,523	30,389	23,699	575	29,560	6,116½		
Cost per dozen for production	25.42c	24.34c	20.03c	45.56c	19.46c	32.58c	14.92c	22.33c	76.01c		
Net charge to production of pork	$648 28	$4,068 48	$861 04	$5,555 52	$3,150 44	$12,569 00	$8 73	$4,155 51	$3,418 97	$2,155 80	None produced
Total pounds of pork consumed	5,612	33,580	36,301	45,253	64,633	95,942	1,323	38,018	38,241	6,265	
Cost per pound for production	11.55c	12.12c	02.37c	12.28c	04.87c	13.10c	0.66c	10.93c	08.94c	34.41c	
Local products in quantities—											
Consumed at institution:											
Vegetables consumed or canned, pounds	970,887	883,525	958,600	920,853	1,166,515	2,406,086	29,698	325,978	330,064	60,833	77,640
Poultry and rabbits, lbs.	4,207	8,045	12,830	3,836	9,056	7,876	303	15,296	1,490		879
Fruits, consumed or canned, pounds	51,543	38,631	217,456	25,946	103,472	498,445	64	179,675		22,630	21,970
Fruits, dried, pounds		1,510	118,595							709	741
Citrus fruits, pounds				3,725	128,472					801 bx.	10,000
Miscellaneous, pounds			1,480							1,293	
Honey, pounds					1,722						800
Beef and veal, etc., dressed pounds		15,262	26,662	6,360	10,876	39,737	404	37,986	7,010	1,109	
Consumed in production or sold:											
Fruits and vegetables, pounds	424,914					3,047			95,666	1,400	107,513
Fertilizer, bones, etc., tons	198	744	922	1,108	1,200	2,005	100	893			
Alfalfa, hay, grains and other feeds, tons	$267 79	$1,157 74 [2]	$1,414 37 [3]	$1,236 70 [4]	$2,243 65 [5]	$1,570 32 [6]	$239 74	$104 23 [7]	$807 25	$10 50	
Miscellaneous											

[1] Increase.
[2] 258 cord wood.
[3] 2,113 hides.
[4] 700 hides.
[5] 18 hides.
[6] 2,541 lbs. wool.
[7] 162 hides.

TABLE No. 1.—Movement of Patients for the Year Ending June 30, 1927

	Stockton			Napa			Agnews			Mendocino			Patton			Norwalk			Cross totals		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
INSANE																					
Number of patients June 30, 1926	1,787	1,111	2,898	1,469	1,310	2,779	960	781	1,741	711	375	1,086	1,442	1,112	2,554	638	582	1,220	7,007	5,271	12,278
Number admitted to June 30, 1927	493	198	691	378	297	675	276	222	498	140	60	200	418	255	673	442	319	761	2,147	1,351	3,498
Number returned elopers	112	3	115	74	13	87	5	------	5	27	2	29	107	6	113	52	4	56	377	28	405
Number returned paroles	84	122	206	213	305	518	51	78	129	47	14	61	143	180	323	104	151	255	642	850	1,492
Number under care and treatment	2,476	1,434	3,910	2,134	1,925	4,059	1,292	1,081	2,373	925	451	1,376	2,110	1,553	3,663	1,236	1,056	2,292	10,173	7,500	17,673
Number discharged—recovered	98	76	174	98	134	232	47	46	93	40	15	55	82	70	152	50	53	103	415	394	809
Number discharged—improved	120	22	142	108	90	198	51	27	78	13	6	19	105	49	154	76	51	127	473	245	718
Number discharged—unimproved	31	3	34	22	9	31	4	12	16	28	5	33	39	12	51	20	6	26	144	47	191
Number discharged—not insane	6	6	12	7	1	8	10	7	17	5	2	7	1	------	1	5	1	6	34	17	51
Number discharged—by order of court	1	------	1	2	2	4	1	1	2	------	------	------	------	------	------	------	1	1	4	4	8
Number transferred to other hospitals	9	26	35	32	3	35	1	1	2	2	26	28	4	2	6	1	------	1	49	58	107
Number died	221	68	289	141	106	247	92	90	182	40	19	59	155	74	229	114	77	191	763	434	1,197
Number eloped	96	2	98	70	10	80	8	------	8	28	------	28	116	6	122	61	2	63	379	20	399
Number paroled	76	101	177	170	229	399	82	94	176	15	9	24	139	173	312	126	165	291	608	771	1,379
Discharged, died, eloped, paroled	658	304	962	650	584	1,234	296	278	574	171	82	253	641	386	1,027	453	356	809	2,869	1,990	4,859
Actual number in hospital	1,818	1,130	2,948	1,484	1,341	2,825	996	803	1,799	754	369	1,123	1,469	1,167	2,636	783	700	1,483	7,304	5,510	12,814
Number on elopement	36	------	36	21	------	21	7	------	7	86	------	86	83	------	83	32	------	32	265	------	265
Number on parole	60	82	142	123	150	273	59	37	96	17	20	37	119	144	263	93	95	188	471	528	999
Grand total on records	1,914	1,212	3,126	1,628	1,491	3,119	1,062	840	1,902	857	389	1,246	1,671	1,311	2,982	908	795	1,703	8,040	6,038	14,078
ALCOHOLIC																					
Number of patients June 30, 1926	5	2	7	7	4	11	5	1	6	11	6	17	9	----	9	8	1	9	45	14	59
Number received to June 30, 1927	30	6	36	35	16	51	24	2	26	51	12	63	61	5	66	25	5	30	226	46	272
Number returned elopers	2	------	2	4	2	6	----	------	----	10	----	10	11	----	11	6	----	6	33	2	35
Number returned paroles	13	3	16	6	12	18	2	------	2	15	3	18	9	1	10	18	3	21	63	22	85
Number under care and treatment	50	11	61	52	34	86	31	3	34	87	21	108	90	6	96	57	9	66	367	84	451

Number discharged—recovered																						
Number discharged—term expired	9	1	10	6	11	17	8		8	13	3	16	1	1	2				37	16	53
Number discharged—further treatment not beneficial	14	2	16	21	2	23	6	2	8	29	4	33	37	2	39	27	4	31	134	16	150
Discharged—illegal commitment							1		1										1		1
Number died	3		3		1	1	2		2	1		1	1		1	1		1	8	1	9
Number transferred to other hospitals																					
Number eloped	3		3	4	2	6				12		12	13		13	6		6	38	2	40
Number paroled	11	5	16	5	15	20	3	1	4	16	3	19	15	1	16	14	3	17	64	28	92
Discharged, died, eloped, paroled	40	8	48	36	31	67	20	3	23	71	10	81	67	4	71	48	7	55	282	63	345
Actual number in hospital	10	3	13	16	3	19	11		11	16	11	27	23	2	25	9	2	11	85	21	106
Number on elopement	1		1							5		5	2		2	1		1	9		9
Number on parole	3	3	6	1	8	9	3	1	4	11	3	14	8		8	5		5	31	15	46
Grand total on records	14	6	20	17	11	28	14	1	15	32	14	46	33	2	35	15	2	17	125	36	161
DRUG ADDICTS																					
Number of patients June 30, 1926	6	2	8	7	1	8	3	2	5	14	3	17	14	3	17	3	2	5	47	13	60
Number admitted to June 30, 1927	12	3	15	9	7	16	12	2	14	21	6	27	29	8	37	10	3	13	93	29	122
Number returned elopers	2		2	4		4				25		25	6		6	9		9	46		46
Number returned paroles	3	2	5	2	3	5				1	2	3	7	5	12	4	2	6	17	14	31
Number under care and treatment	23	7	30	22	11	33	15	4	19	61	11	72	56	16	72	26	7	33	203	56	259
Number discharged—recovered											1	1	9	2	11				9	3	12
Number discharged—term expired	2		2	2	3	5	1		1	2	3	5	1	1	2	2		2	10	7	17
Number discharged—further treatment not beneficial	13	4	17	11	1	12	10	3	13	30	1	31	27	4	31	11	3	14	102	16	118
Number discharged—illegal commitment	2		2																2		2
Number died				1		1													1		1
Number transferred to other hospitals																					
Number eloped	2		2	5	1	6				18		18	7		7	8		8	40	1	41
Number paroled	1	2	3	3	1	4				2	1	3	7	5	12	4	2	6	17	11	28
Discharged, died, eloped, paroled	20	6	26	22	6	28	11	3	14	52	6	58	51	12	63	25	5	30	181	38	219
Actual number in hospital	3	1	4		5	5	4	1	5	9	5	14	5	4	9	1	2	3	22	18	40
Number on elopement	1		1	1	1	2				2		2	3		3	1		1	8	1	9
Number on parole	2	3	5	2	1	3				1		1	4	2	6	1		1	10	6	16
Grand total on records	6	4	10	3	7	10	4	1	5	12	5	17	12	6	18	3	2	5	40	25	65
VOLUNTARY																					
Number of patients June 30, 1926	44	60	104	25	22	47	37	57	94	4	2	6	28	24	52	9	3	12	147	168	315
Number admitted to June 30, 1927	51	56	107	9	18	27	21	45	66	4	3	7	17	6	23	1	7	8	103	135	238
Number returned elopers	4		4	1		1													5		5
Number returned paroles	5	29	34				5	2	7										10	31	41
Number under care and treatment	104	145	249	35	40	75	63	104	167	8	5	13	45	30	75	10	10	20	265	334	599

TABLE No. 1.—Movement of Patients for the Year Ending June 30, 1927

	Stockton			Napa			Agnews			Mendocino			Patton			Norwalk			Cross totals		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Number discharged	39	42	81	12	21	33	22	40	62	3	1	4	6	8	14	3	3	6	85	115	200
Number died	9	5	14	1	1	2	2	8	10				3	1	4				15	15	30
Number eloped	3		3	1		1													4		4
Number paroled	6	15	21				4	1	5										10	16	26
Discharged, died, eloped, paroled	57	62	119	14	22	36	28	49	77	3	1	4	9	9	18	3	3	6	114	146	260
Actual number in hospital	47	83	130	21	18	39	35	55	90	5	4	9	36	21	57	7	7	14	151	188	339
Number on elopment																			3	7	10
Number on parole	3	7	10																		
Grand total on records	50	90	140	21	18	39	35	55	90	5	4	9	36	21	57	7	7	14	154	195	349
RECAPITULATION																					
Insane	1,818	1,130	2,948	1,484	1,341	2,825	996	803	1,799	754	369	1,123	1,469	1,167	2,636	783	700	1,483	7,304	5,510	12,814
Alcoholics	10	3	13	16	3	19	11		11	16	11	27	23	2	25	9	2	11	85	21	106
Drug addicts	3	1	4		5	5	4	1	5	9	5	14	5	4	9	1	2	3	22	18	40
Voluntary	47	83	130	21	18	39	35	55	90	5	4	9	36	21	57	7	7	14	151	188	339
Total actual number in hospital June 30, 1927	1,878	1,217	3,095	1,521	1,367	2,888	1,046	859	1,905	784	389	1,173	1,533	1,194	2,727	800	711	1,511	7,562	5,737	13,299

TABLE No. 1.—Movement of Patients for the Year Ending June 30, 1928

	Stockton			Napa			Agnews			Mendocino			Patton			Norwalk			Cross totals		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
INSANE																					
Number of patients June 30, 1927	1,818	1,130	2,948	1,484	1,341	2,825	996	803	1,799	754	369	1,123	1,469	1,167	2,636	783	700	1,483	7,304	5,510	12,814
Number admitted to June 30, 1928	489	223	712	373	268	641	271	252	523	186	92	278	668	299	967	346	348	694	2,333	1,482	3,815
Number returned elopers	110	7	117	75	4	79	2	------	2	30	------	30	126	1	127	85	2	87	428	14	442
Number returned paroles	57	83	140	181	263	444	84	90	174	10	14	24	207	240	447	147	187	334	686	877	1,563
Number under care and treatment	2,474	1,443	3,917	2,113	1,876	3,989	1,353	1,145	2,498	980	475	1,455	2,470	1,707	4,177	1,361	1,237	2,598	10,751	7,883	18,634
Number discharged—recovered	86	56	142	93	63	156	51	60	111	33	19	52	154	99	253	64	74	138	481	371	852
Number discharged—improved	101	12	113	119	99	218	68	23	91	5	2	7	164	75	239	118	61	179	575	272	847
Number discharged—unimproved	28	4	32	40	9	49	8	5	13	16	1	17	36	13	49	11	6	17	139	38	177
Number discharged—not insane	17	3	20	6	3	9	6	13	19	7	1	8	14	2	16	8	------	8	58	22	80
Number discharged—by order of court	------	------	------	2	1	3	------	------	------	------	------	------	------	1	1	------	------	------	2	2	4
Number transferred to other hospitals	6	2	8	8	12	20	7	5	12	11	8	19	41	47	88	------	------	------	73	74	147
Number died	206	84	290	155	105	260	110	72	182	53	15	68	133	64	197	102	92	194	759	432	1,191
Number eloped	83	113	196	149	249	398	3	------	3	17	------	17	202	215	417	76	3	79	530	580	1,110
Number paroled	96	9	105	65	5	70	74	114	188	9	10	19	144	2	146	152	211	363	540	351	891
Discharged, died, eloped, paroled	623	283	906	637	546	1,183	327	292	619	151	56	207	888	518	1,406	531	447	978	3,157	2,142	5,299
Actual number in hospital	1,851	1,160	3,011	1,476	1,330	2,806	1,026	853	1,879	829	419	1,248	1,582	1,189	2,771	830	790	1,620	7,594	5,741	13,335
Number on elopment	22	2	24	11	1	12	8	------	8	80	------	80	101	1	102	23	1	24	245	5	250
Number on parole	86	112	198	91	136	227	49	61	110	16	18	34	114	119	233	98	119	217	454	565	1,019
Grand total on records	1,959	1,274	3,233	1,578	1,467	3,045	1,083	914	1,997	925	437	1,362	1,797	1,309	3,106	951	910	1,861	8,293	6,311	14,604
ALCOHOLIC																					
Number of patients June 30, 1927	10	3	13	16	3	19	11	------	11	15	11	26	23	2	25	9	2	11	84	21	105
Number received to June 30, 1928	24	3	27	28	10	38	34	6	40	78	20	98	52	6	58	25	1	26	241	46	287
Number returned elopers	6	------	6	1	2	3	2	------	2	15	------	15	7	1	8	3	------	3	34	3	37
Number returned paroles	11	7	18	14	13	27	4	1	5	18	4	22	19	2	21	21	3	24	87	30	117
Number under care and treatment	51	13	64	59	28	87	51	7	58	126	35	161	101	11	112	58	6	64	446	100	546

	Stockton			Napa			Agnews			Mendocino			Patton			Norwalk			Cross totals		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
ALCOHOLIC—Continued																					
Number discharged—recovered										1	2	3	2	2	4				3	4	7
Number discharged—term expired	10	5	15	10	8	18	2		2	24	3	27	1	2	3	5		5	52	18	70
Number discharged—further treatment not beneficial	15	3	18	18	6	24	30	5	35	28	16	44	62	2	64	21	3	24	174	35	209
Number discharged—illegal commitment																					
Number discharged—by order of court					1	1														1	1
Number died	2		2	1		1				3		3	1		1				7		7
Number transferred to other hospitals																					
Number eloped	5		5	3	2	5	2		2	24		24	6	1	7	3		3	43	3	46
Number paroled	8	4	12	15	5	20	7		7	20	9	29	14	3	17	22	3	25	86	24	110
Discharged, died, eloped, paroled	40	12	52	47	22	69	41	5	46	100	30	130	86	10	96	51	6	57	365	85	450
Actual number in hospital	11	1	12	12	6	18	10	2	12	26	5	31	15	1	16	7		7	81	15	96
Number on elopment				2		2				15		15	1		1	1		1	19		19
Number on parole		1	1	2		2	6		6	13	6	19	3	1	4	6		6	30	8	38
Grand total on records	11	2	13	16	6	22	16	2	18	54	11	65	19	2	21	14		14	130	23	153
DRUG ADDICTS																					
Number of patients June 30, 1927	3	1	4		5	5	4	1	5	10	5	15	5	4	9	1	2	3	23	18	41
Number admitted to June 30, 1928	15	4	19	13	2	15	13	1	14	26	8	34	18	3	21	12	1	13	97	19	116
Number returned elopers	1		1	7	1	8	1		1	2		2	3		3	5		5	19	1	20
Number returned paroles		3	3	2	6	8	1		1	2		2	7	5	12	4	2	6	16	16	32
Number under care and treatment	19	8	27	22	14	36	19	2	21	40	13	53	33	12	45	22	5	27	155	54	209
Number discharged—recovered																					
Number discharged—term expired		2	2	2	6	8				4		4	4	3	7				10	11	21
Number discharged—further treatment not beneficial	9	2	11	8	1	9	12	2	14	6	8	14	21	3	24	8	3	11	64	19	83
Number discharged—illegal commitment	2	1	3																2	1	3
Number died					1	1										1		1	1	1	2
Number transferred to other hospitals																					
Number eloped	1		1	7		7	3		3	25		25	2		2	6		6	44		44
Number paroled	2	3	5		6	6	1		1	1	2	3	3	4	7	4	2	6	11	17	28
Discharged, died, eloped, paroled	14	8	22	17	14	31	16	2	18	36	10	46	30	10	40	19	5	24	132	49	181
Actual number in hospital	5		5	5		5	3		3	4	3	7	3	2	5	3		3	23	5	28

Number on elopement	1		1	1		1	2		2	16		16	2		2	2		2	24		24
Number on parole	4	2	6		1	1					1	1		1	1	1		1	5	5	10
Grand total on records	10	2	12	6	1	7	5		5	20	4	24	5	3	8	6		6	52	10	62
VOLUNTARY																					
Number of patients June 30, 1927	47	83	130	21	18	39	35	55	90	5	4	9	36	21	57	7	7	14	151	188	339
Number admitted to June 30, 1928	42	35	77	17	18	35	40	29	69	11	2	13	20	10	30	6	2	8	136	96	232
Number returned elopers	4		4							1		1							5		5
Number returned paroles	3	21	24	1		1	2	5	7										6	26	32
Number under care and treatment	96	139	235	39	36	75	77	89	166	17	6	23	56	31	87	13	9	22	298	310	608
Number discharged	38	23	61	14	12	26	25	32	57	7	4	11	21	7	28	6	4	10	111	82	193
Number died	9	5	14	1	2	3	5	2	7	1		1		1	1	2	1	3	18	11	29
Number eloped	5		5							1		1							6		6
Number paroled	1	32	33	1		1	3	5	8										5	37	42
Discharged, died, eloped, paroled	53	60	113	16	14	30	33	39	72	9	4	13	21	8	29	8	5	13	140	130	270
Actual number in hospital	43	79	122	23	22	45	44	50	94	8	2	10	35	23	58	5	4	9	158	180	338
Number on elopement	1		1																1		1
Number on parole	1	18	19				1		1										2	18	20
Grand total on records	45	97	142	23	22	45	45	50	95	8	2	10	35	23	58	5	4	9	161	198	359
RECAPITULATION																					
Insane	1,851	1,160	3,011	1,476	1,330	2,806	1,026	853	1,879	829	419	1,248	1,582	1,189	2,771	830	790	1,620	7,594	5,741	13,335
Alcoholics	11	1	12	12	6	18	10	2	12	27	5	32	15	1	16	7		7	82	15	97
Drug addicts	5		5	5		5	3		3	3	3	6	3	2	5	3		3	22	5	27
Voluntary	43	79	122	23	22	45	44	50	94	8	2	10	35	23	58	5	4	9	158	180	338
Total actual number in hospital June 30, 1928	1,910	1,240	3,150	1,516	1,358	2,874	1,083	905	1,988	867	429	1,296	1,635	1,215	2,850	845	794	1,639	7,856	5,941	13,797

TABLE No. 2

Nativity of First Admissions for the Biennial Period Ended June 30, 1928

Nativity	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
United States	379	345	339	344	256	254	63	93	353	500	434	395	3,755
Africa	1	1		1		1						1	5
Asia[1]	2		2							1			5
Australia	2	2	2	3		2		1				1	13
Austria	13	7	4	4		5	2	1	8	7	5	6	62
Belgium			1		2			1		1			5
Canada[2]	12	7	10	13	11	10	2	8	13	14	13	16	129
Central America	3		1	1		1							6
China	13	9	6	8	1	4	2	3	2	2		4	54
Czecho-Slovakia	2					3				1			6
Cuba									1		1		2
Denmark	1	4	4	4	5	1	1	1	3	2	2	2	30
England	9	11	7	17	11	16		1	9	15	14	11	121
Europe[1]		14	2		3						4	3	26
Finland		4	5	4	1	1	2	8		1	2	1	29
France	2	4	4	3	3	4	1		1	3	2	5	32
Germany	29	20	37	19	8	17	9	6	15	13	13	7	193
Greece	7	7	3	1	4			2	2	2	1	3	32
Holland	4	3		1					2	1	1	1	13
Hungary	6	2	3	3	2	2	2	1	2	2	7	1	33
India	1	1		1			1	2					6
Ireland	23	22	27	13	16	12	5	3	7	11	7	4	150
Italy	27	32	27	30	22	29	8	8	11	12	13	12	231
Japan	9	9	1	8	5	2		2	3	5	8	7	59
Jugo-Slavia	5	2		3	1	4					1		16
Mexico	23	29	11	4	5	2	3	3	50	66	51	41	288
Norway	1	6	1	4	3	4	3	3	3	4	5		37
Philippine Islands	13	12	3		7	5	3		4	1	2	3	53
Poland	1	1	4	2	1				2	6	5	4	26
Porto Rico			3		2	2		1		3	1		12
Portugal	16	5	8	7	12	8		1	1				58
Roumania	3			1		1	1			1		1	8
Russia	10	11	8	10	1	2	3	4	9	18	11	6	93
Scotland		4	2	3	4	2	1	2	1	4	4	3	30
South America							1	1	1	1	1	2	7
Spain	4	2	5	2	3	1	1	1	2	2		3	26
Sweden	15	9	11	9	3	4	2	3	9	7	3	8	83
Switzerland	4	5	9	6	4	4		3	6	4	4	2	51
Turkey in Asia	1		1			1							3
Turkey in Europe	2	1		1					2				6
Wales					1				1			1	3
West Indies[3]	1		1							2	1		5
Other countries	1	16		1	4	6	1	1	2	14	3	1	50
Unascertained	12	15	1	5	5	5	1	6	12	18	17	10	107
Totals	657	622	553	536	406	415	118	170	537	744	636	565	5,959

[1] Not otherwise specified.
[2] Includes Newfoundland.
[3] Except Cuba and Porto Rico.

TABLE No. 3

Citizenship of First Admissions for the Biennial Period Ended June 30, 1928

	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
Citizens by birth	379	345	349	344	260	258	68	94	359	503	434	395	3,788
Citizens by naturalization	71	64	76	62	28	56	13	3	33	38	39	31	514
Aliens	144	135	61	78	60	69	29	18	77	115	66	67	919
Citizenship unascertained	63	78	67	52	58	32	8	55	68	88	97	72	738
Totals	657	622	553	536	406	415	118	170	537	744	636	565	5,959

TABLE No. 4

Psychoses of First Admissions for the Biennial Period Ended June 30, 1928

Psychoses	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
Traumatic psychoses	5	2	2	1	2	1	1		1	5		1	21
Senile psychoses	56	56	50	42	41	46	5	4	42	35	17	14	408
Psychoses with cerebral arteriosclerosis	85	93	68	69	33	32	18	34	14	26	44	54	570
General paralysis	55	47	64	59	44	52	15	24	83	122	141	99	805
Psychoses with cerebral syphilis	14	8	7	9	3			5	12	14	1	3	76
Psychoses with Huntington's chorea	1					2		1	1	2		1	8
Psychoses with brain tumor				2		1			1				4
Psychoses with other brain or nervous diseases		9	1	4	5	2	6	2	1	4	5	5	44
Alcoholic psychoses	70	51	30	36	14	11	8	10	12	26	9	4	281
Psychoses due to drugs and other exogenous toxins	5	3	1	2	2		1		3	4	1		22
Psychoses with pellagra					1					1	1	1	4
Psychoses with other somatic diseases	32	40	15	9	12	15	5	6	14	18	15	9	190
Manic-depressive psychoses	64	54	189	127	47	56	17	13	127	160	133	144	1,131
Involution melancholia	13	14		4	33	20		1	4	5	8	7	109
Dementia praecox (schizophrenia)	127	110	53	96	117	95	20	36	179	241	153	133	1,360
Paranoia and paranoid conditions			29	21	4	13		1	2	7	1		78
Epileptic psychoses	17	15	9	15	7	10		3	14	24	35	23	172
Psychoneuroses and neuroses	7	7	3	7	3	2	3	6	5	9	5	4	61
Psychoses with psychopathic personality	4	2	9	8	4	6	1	2	4	6	14	9	69
Psychoses with mental deficiency	20	22	12	8	10	17	5	9	10	6	34	32	185
Undiagnosed psychoses	50	62	2	2	12	11	3	6	1	7	12	14	182
Without psychoses:													
a. Epilepsy without psychosis	5	3	1	1	1	6		3		4			24
b. Alcholism without psychosis		1		3	3	2	2	2					13
c. Drug addiction without psychosis							1						1
d. Psychopathic personality without psychosis	1	3	4	4	2	3			2	8		3	30
e. Mental deficiency without psychosis	11	7	1	4	1	6	4	1	3	5	3	1	47
f. Others	15	13	3	3	5	6	3	1	2	5	4	4	64
Totals	657	622	553	536	406	415	118	170	537	744	636	565	5,959

TABLE No. 5

Age of First Admissions, for the Biennial Period Ended June 30, 1928

Age	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
Under 15 years	4	3	1	------	1	2	------	------	------	1	1	1	14
15-19 years	24	22	11	22	8	18	2	9	14	21	33	23	207
20-24 years	52	42	30	44	32	32	10	17	46	61	58	53	477
25-29 years	61	65	56	43	46	27	18	15	63	97	74	80	645
30-34 years	87	61	57	55	49	34	11	11	68	109	75	58	675
35-39 years	64	76	62	56	45	43	17	20	79	85	77	81	705
40-44 years	67	62	54	55	38	40	19	18	77	104	93	73	700
45-49 years	67	66	60	56	32	52	7	20	64	78	75	53	630
50-54 years	46	47	43	42	35	51	7	10	45	55	60	48	489
55-59 years	35	33	43	40	28	27	8	11	25	51	28	33	362
60-64 years	42	37	34	29	24	27	4	9	19	26	26	27	304
65-69 years	22	31	29	31	18	21	2	6	15	22	17	9	223
70 years and over	70	68	71	57	47	38	11	21	22	32	17	19	473
Unascertained	16	9	2	6	3	3	2	3	------	2	2	7	55
Totals	657	622	553	536	406	415	118	170	537	744	636	565	5,959

TABLE No. 6

Degree of Education of First Admissions, for the Biennial Period Ended June 30, 1928

Education	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
Illiterate	71	69	31	21	31	29	6	10	35	30	39	19	391
Reads and writes	72	70	43	44	19	17	14	5	53	72	15	23	447
Common school	424	389	382	367	265	285	83	110	299	422	404	350	3,780
High school	46	42	67	64	52	47	5	12	83	103	91	100	712
College	9	15	15	23	14	19	2	3	36	50	20	27	233
Unascertained	35	37	15	17	25	18	8	30	31	67	67	46	396
Totals	657	622	553	536	406	415	118	170	537	744	636	565	5,959

TABLE No. 7

Environment of First Admissions, for the Biennial Period Ended June 30, 1928

Environment	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
Urban	365	396	439	447	273	310	91	92	504	694	564	551	4,726
Rural	200	136	113	87	97	90	19	75	29	48	23	9	926
Unascertained	92	90	1	2	36	15	8	3	4	2	49	5	307
Totals	657	622	553	536	406	415	118	170	537	744	636	565	5,959

TABLE No. 8

Economic Condition of First Admissions, for the Biennial Period Ended June 30, 1928

Economic condition	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
Dependent	128	95	21	19	123	125	83	141	199	203	15	7	1,159
Marginal	416	424	376	367	216	224	3	2	230	498	396	453	3,605
Comfortable	------	------	134	144	42	55	27	24	106	41	88	83	744
Unascertained	113	103	22	6	25	11	5	3	2	2	137	22	451
Totals	657	622	553	536	406	415	118	170	537	744	636	565	5,959

TABLE No. 9

Use of Alcohol by First Admissions, for the Biennial Period Ended June 30, 1928

Alcoholic addiction	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
Abstinent	407	380	240	255	273	287	38	84	328	455	385	394	3,526
Temperate	171	170	228	198	68	63	53	45	107	148	100	73	1,424
Intemperate	25	21	57	57	43	40	24	20	62	73	72	31	525
Unascertained	54	51	28	26	22	25	3	21	40	68	79	67	484
Totals	657	622	553	536	406	415	118	170	537	744	636	565	5,959

TABLE No. 10

Marital Condition of First Admissions, for the Biennial Period Ended June 30, 1928

Marital condition	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
Single	303	274	186	197	146	131	58	100	229	312	214	155	2,305
Married	206	210	215	214	175	193	37	36	195	270	293	283	2,327
Widowed	76	87	97	76	49	45	8	19	41	58	47	55	649
Separated	8	6	8	6	6	1	------	3	29	47	20	21	155
Divorced	30	28	36	34	18	24	10	11	36	45	46	39	357
Unascertained	34	26	11	9	12	21	5	1	7	12	16	12	166
Totals	657	622	553	536	406	415	118	170	537	744	636	565	5,959

TABLE No. 11

Psychoses of Readmissions for the Biennial Period Ended June 30, 1928

Psychoses	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
Traumatic psychoses	1	1			1					24			27
Senile psychoses	3	3	4	3	3	4	3				1		24
Psychoses with cerebral arteriosclerosis	13	15	6	8	2	2	2	1			2	6	57
General paralysis	1	5	4	6	5	7	1		5		2	8	44
Psychoses with cerebral syphilis	1		1	3	1		1		1				8
Psychoses with Huntington's chorea													
Psychoses with brain tumor													
Psychoses with other brain or nervous diseases		1	1	1		1				2			6
Alcoholic psychoses	9	11	4	9	8	2	3	4	9	13	2		74
Psychoses due to drugs and other exogenous toxins	1					1				1			3
Psychoses with pellagra				1									1
Psychoses with other somatic diseases	5	3			2		2		1	1	1	1	16
Manic-depressive psychoses	17	49	78	61	61	60	7	10	66	89	54	51	603
Involution melancholia			1		8	9		1	2			1	22
Dementia praecox	30	46	26	24	42	59	6	6	52	68	46	25	440
Paranoia and paranoid conditions			1	5		2		1	3	2			14
Epileptic psychoses	5	1	3	2	2	3	2	1	1	4	5	6	35
Psychoneuroses and neuroses			3	2	6	5		2	1	1		1	21
Psychoses with psychopathic personality	1	2	5	4	2	4			2	1		2	23
Psychoses with mental deficiency	8	5	2	6	3	5	1	2	9	5	8	14	68
Undiagnosed psychoses	13	10	2		1	2					2		30
Without psychosis	4	10	2	2	6	2	2	1	3	4	2	2	40
Totals	112	162	143	137	153	168	30	29	155	215	125	127	1,556

TABLE No. 12

Causes of Death of Patients During the Biennial Period Ended June 30, 1928

Cause of death	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
I. Epidemic, endemic and infectious diseases:													
Typhoid and paratyphoid fever	1		4	1		1							7
Measles													
Scarlet fever													
Diphtheria													
Influenza		1				1			8	4			14
Dysentery													
Eyrsipelas		1			1					2			4
Lethargic encephalitis	1			1	2								4
Tuberculosis of the respiratory system	7	40	21	17	13	19	4	3	27	19	35	74	229
Tuberculosis of other organs	35			1	2		1		1			2	42
Syphilis (nonnervous forms)	1	2						2		1			6
Purulent infection, septicaemia	1	1	1	6	1	2			1	1		1	15
Other infectious diseases													
II. General diseases not included in class 1:													
Cancer and other malignant tumors	5	2	3	6	3	1	3	1	5	8	1	3	41
Tumor (noncancerous)		2						1		2			5
Rheumatism													
Pellagra	1		1	1	1	1				3			8
Diabetes	1		1		2				1				5
Alcholism (acute or cnronic)	1	2			1								4
Other general dieseases	2	2	2		1	2			1				10
III. Diseases of the nervous system:													
Meningitis (nonepidemic)							2						2
Tabes dorsalis (locomotor ataxia)						1			2			1	4
Other diseases of spinal cord			2							2			4
Cerebral hemorrhage, apoplexy	31	23	12	13	23	13	2	1	17	7	7	5	154
General paralysis of the insane	50	62	43	46	37	43	14	13	61	58	65	63	555
Other forms of mental disease	26	34	9	13	14	29		2	2	1	14	2	146
Epilepsy	4	9	4	4	4	4	4	1	8	7	1	4	54
Chorea		1	2										3
Other diseases of the nervous system				1	2		2				2	7	14
IV. Diseases of the circulatory system:													
Pericarditis		1											1
Endocarditas and myocarditis	8	6	53	50	9	14	8	6	61	42	22	45	324
Angina pectoris													
Other diseases of the heart	8	2	1	2	20	4	3	1		2	8	6	57
Arteriosclerosis	94	93	26	69	27	28	5	20	3	2	19	19	405
Other diseases of the arteries				2				1	2			1	6
Other diseases of the circulatory system			3						16	20			39

TABLE No. 12—Continued

Causes of Death of Patients During the Biennial Period Ended June 30, 1928

Cause of death	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
V. Diseases of the respiratory system:													
Bronchitis			1	2						2			5
Bronchopneumonia	7		25	12	4	4	2	5	3	1	2	3	70
Lobar pneumonia	2	4	5	1	1	2	1	1		3	5	3	28
Pleurisy													
Asthma	1		1										2
Other diseases of the respiratory system (tuberculosis excepted)	2		2							1	1	1	7
VI. Diseases of the digestive system:													
Diseases of the pharynx and tonsils													
Ulcer of stomach and duodenum					2	1		2	2				7
Other diseases of stomach (cancer excepted)										1			1
Diarrhea and enteritis			10	4	3	2					1		20
Appendicitis and typhlitis													
Hernia and intestinal obstruction			2	1	1	1			2	1	1		9
Other diseases of intestines			1					1	1				3
Cirrhosis of liver	2		2										4
Biliary calculi													
Other diseases of liver	2	2							1	1			6
Other diseases of digestive system (cancer and tuberculosis excepted)				1			1						2
VII. Nonvenereal diseases of genito-urinary system and annexa:													
Nephritis	5	6	4	1	13	13	1	5	6	1	2		57
Other diseases of kidneys and annexa													
Diseases of bladder			1										1
Diseases of prostate						2						1	3
Benign tumors of uterus					1								1
Other diseases of genital organs							1						1
Other diseases of genito-urinary system							1						1
VIII. Diseases of the skin and of the cellular tissue:													
Gangrene		1			1	1				2			5
Other diseases of skin and annexa													
IX. Diseases of the bones and of the organs of locomotion (tuberculosis and rheumatism excepted)							1		1				2
X. Other diseases not included in above groups	1									1		1	3
XI. External causes:													
Suicide	3	2	4	5	2		1	2	1	2	2	3	27
Homicide													
Accidental poisoning													
Accidental traumatism	1	3	2	2	1		1	1		1		1	13
Other external causes		2		1			1				1	1	6
Totals	303	304	248	263	192	189	59	69	233	198	191	197	2,446

TABLE No. 13

Duration of Hospital Life of Patients Dying During the Biennial Period Ended June 30, 1928

Duration of hospital life	Stockton		Napa		Agnews		Mendocino		Patton		Norwalk		Total
	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	
Less than 1 month	32	36	42	28	38	45	3	7	19	38	57	51	396
1- 3 months	36	28	38	43	30	42	11	13	35	26	26	33	361
4- 7 months	26	20	24	25	21	17	7	5	21	14	16	16	212
8-12 months	23	29	14	21	13	10	4	2	22	6	9	13	166
1- 2 years	55	72	49	56	32	27	7	14	45	35	45	53	490
3- 4 years	29	34	17	26	13	7	4	6	26	18	15	19	214
5- 6 years	28	15	7	7	6	9	3	3	13	11	8	3	113
7- 8 years	20	12	5	13	7	5	3	3	6	13	4	3	94
9-10 years	3	14	5	5	4	2	2	1	10	7	5	3	61
11-12 years	10	7	2	7	2	4	1	2	6	8	1	------	50
13-14 years	6	5	8	3	3	9	2	6	2	4	1	------	49
15-19 years	11	8	13	9	2	6	2	4	14	6	1	3	79
20 years and over	24	24	24	20	21	6	10	3	14	12	3	------	161
Totals	303	304	248	263	192	189	59	69	233	198	191	197	2,446

SONOMA STATE HOME AND PACIFIC COLONY

TABLE No. 1

Population Report, July 1, 1926, to June 30, 1927

	Sonoma			Pacific Colony			Cross totals		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Population, July 1, 1926	1,115	998	2,113	------	------	------	1,115	998	2,113
Admissions	173	213	386	27	39	66	200	252	452
Returned elopers	54	15	69	------	------	------	54	15	69
Returned paroles	309	304	613	------	------	------	309	304	613
Total receiving care and treatment	1,651	1,530	3,181	27	39	66	1,678	1,569	3,247
Number out:									
Improved	18	26	44	------	------	------	18	26	44
Unimproved	3	5	8	------	------	------	3	5	8
Transferred to other hospitals	3	4	7	------	------	------	3	4	7
By order of court	------	2	2	------	------	------	------	2	2
Died	39	28	67	------	------	------	39	28	67
Paroled	365	356	721	3	2	5	368	358	726
Eloped	69	15	84	------	------	------	69	15	84
Totals	497	436	933	3	2	5	500	438	938
Population, June 30, 1927	1,154	1,094	2,248	24	37	61	1,178	1,131	2,309
On escape	100	5	105	------	------	------	100	5	105
On parole	378	414	792	3	2	5	381	416	797
Actual population at end of year	1,632	1,513	3,145	27	39	66	1,659	1,552	3,211

TABLE No. 2

Population Report, July 1, 1927, to June 30, 1928

	Sonoma			Pacific Colony			Cross totals		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Population, July 1, 1927	1,154	1,094	2,248	24	37	61	1,178	1,131	2,309
Admissions	201	204	405	34	27	61	235	231	466
Returned elopers	79	24	103	4		4	83	24	107
Returned paroles	390	320	710	53	53	106	443	373	816
Total receiving care and treatment	1,824	1,642	3,466	115	117	232	1,939	1,759	3,698
Number out:									
Improved	42	52	94	2		2	44	52	96
Unimproved	9	9	18				9	9	18
Transferred to other hospitals	7	10	17		1	1	7	11	18
By order of court									
Died	50	39	89	2	1	3	52	40	92
Paroled	436	417	853	60	58	118	496	475	971
Eloped	102	33	135	4		4	106	33	139
Totals	646	560	1,206	68	60	128	714	620	1,334
Population, June 30, 1928	1,178	1,082	2,260	47	57	104	1,225	1,139	2,364
On elopement	123	14	137				123	14	137
On parole	424	511	935	10	7	17	434	518	952
Actual population at end of year	1,725	1,607	3,332	57	64	121	1,782	1,671	3,453

TABLE No. 3

Mental Status of Admissions for the Biennial Period Ending June 30, 1928

Mental status	Sonoma		Pacific Colony		Total
	1927	1928	1927	1928	
Idiot	40	37		1	78
Imbecile	107	100	25	51	283
Moron	164	184	40	6	394
Not feeble-minded (exclude epileptics)	27	14			41
Epileptics					
Borderline	45	50			95
Doubtful			1		1
Unascertained	1				1
Totals	384	385	66	58	893

TABLE No. 4

Nativity of Admissions for the Biennial Period Ending June 30, 1928

Nativity	Sonoma		Pacific Colony		Total
	1927	1928	1927	1928	
United States	339	345	61	54	799
Australia		2			2
*Canada	4	11	1	2	18
Central America	1				1
Denmark	2				2
England		2	1		3
France		1			1
Germany	2	1			3
Hawaii	10				10
Ireland	1				1
Italy	1	4			5
Mexico	3	7	2	1	13
Poland		1			1
Portugal	2	1			3
Russia	3	2		1	6
Scotland	1				1
Spain	1	4			5
Wales	1				1
Unascertained	4		1		5
Totals	375	381	66	58	880

* Includes Newfoundland.

TABLE No. 5

Showing Age at Time of First Admission of Patients, for the Biennial Period Ending June 30, 1928

Age	Sonoma		Pacific Colony		Total
	1927	1928	1927	1928	
Under 10 years	72	61		2	135
10-14 years	78	60	13	17	168
15-19 years	134	149	38	23	344
20-24 years	32	44	10	9	95
25-29 years	18	23	2	3	46
30-34 years	11	16	1	4	32
35-39 years	13	11			24
40-44 years	8	2	2		12
45-49 years	5	2			7
50-54 years	2	8			10
55-59 years	1	3			4
60 years and over	1	2			3
Unascertained					
Totals	375	381	66	58	880

TABLE No. 6

Showing Marital Condition of First Admissions, for the Biennial Period Ending June 30, 1928

Marital condition	Sonoma		Pacific Colony		Total
	1927	1928	1927	1928	
Single	327	355	66	58	806
Married	38	18			56
Widowed	5	3			8
Divorced	3	5			8
Separated	2				2
Unascertained					
Totals	375	381	66	58	880

TABLE No. 7

Showing Environment of First Admissions, for the Biennial Period Ending June 30, 1928

Environment	Sonoma		Pacific Colony		Total
	1927	1928	1927	1928	
Urban	315	317	30	39	701
Rural	60	59	19	18	156
Unascertained		5	17	1	23
Totals	375	381	66	58	880

TABLE No. 8

Economic Conditions of Families, of First Admissions for the Biennial Period Ending June 30, 1928

Economic condition	Sonoma		Pacific Colony		Total
	1927	1928	1927	1928	
Dependent	278	255	56	35	624
Marginal	35	56	4	7	102
Comfortable	62	69	6	16	153
Unascertained		1			1
Totals	375	381	66	58	880

TABLE No. 9

Discharges with Reference to Age, for the Biennial Period Ending June 30, 1928

Age	Sonoma		Pacific Colony		Total
	1927	1928	1927	1928	
Under 10 years	1	4			5
10-14 years	5	4			9
15-19 years	20	30		2	52
20-24 years	13	46			59
25-29 years	6	13			19
30-34 years	5	9			14
35-39 years		1			1
40-44 years	2	3			5
45-49 years	1				1
50-54 years					
55-60 years					
60 years and over					
Unascertained					
Totals	53	110		2	165

TABLE No. 10

Deaths with Reference to Age, for the Biennial Period Ending June 30, 1928

Age	Sonoma		Pacific Colony		Total
	1927	1928	1927	1928	
Under 10 years	17	15			32
10-14 years	12	11			23
15-19 years	15	21			36
20-24 years	7	10			17
25-29 years	1	4		1	6
30-34 years	4	3			7
35-39 years	3	3		2	8
40-44 years		3			3
45-49 years	1	4			5
50-54 years	1	5			6
54-59 years	1	5			6
60 years and over	2	2			4
Unascertained					
Totals	64	86		3	153

TABLE No. 11

Causes of Death, for the Biennial Period Ending June 30, 1928

Causes of death	Sonoma		Pacific Colony		Total
	1927	1928	1927	1928	
General diseases:					
Influenza	3	4			7
Lethargic encephalitis		1			1
Tuberculosis of lungs	12	24			36
Syphilis (non-nervous forms)		4			4
Cancer		1		1	2
Diabetes		1			1
Nervous system:					
Cerebro-spinal meningitis		1			1
General paralysis of insane	1				1
Cerebro-spinal syphilis	1				1
Other diseases of brain	3	2			5
Epilepsy	18	20		1	39
Chorea		1			1
Other diseases of nervous system	2				2
Circulatory system:					
Endocarditis and myocarditis	1	3			4
Other diseases of the heart	2				2
Arteriosclerosis	2				2
Other diseases of circulatory system		2			2
Respiratory system:					
Bronchitis				1	1
Bronchopneumonia	7	5			12
Lobar pneumonia	3	1			4
Gangrene of lungs		1			1
Digestive system:					
Diarrhea and enteritis	1	1			2
Appendicitis and typhlitis		1			1
Hernia and intestinal obstruction		3			3
Other diseases of digestive system (cancer and tuberculosis excepted)	1				1
Genito-urinary system:					
Diseases of bladder		1			1
Malformations	2	4			6
Violence:					
Suicide	2				2
Accidental traumatism	1	1			2
Homocide		1			1
Other external violence	2				2
Unascertained	21	3			24
Totals	85	86		3	174

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